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AUTHORITY

USAF ltr 28 Feb 1972

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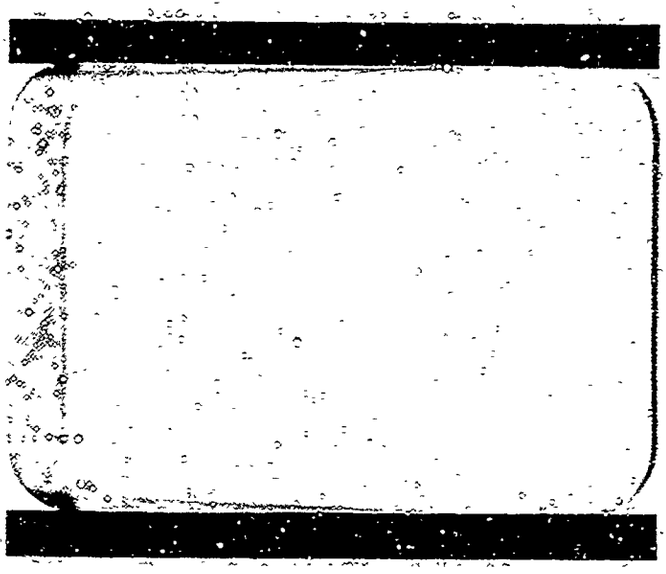

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GENERAL DYNAMICS

Convair Division

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A2136-1 (REV. 5-65)

REPORT NO. 69-00200C
DATE 1-15-66
NO. OF PAGES

GENERAL DYNAMICS | CONVAIR

DETAIL SPECIFICATION FOR ATLAS STANDARD LAUNCH VEHICLE SLV-3 GD/C MODEL 69 (U)

REPORT 69-00200C

DATED 15 January 1966

SUPERSEDES

REPORT 69-00200B

DATED 17 May 1964

CONTRACTS AF04(694)-240
AF04(695)-379
AF04(695)-710

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REVISIONS

NO.	DATE	BY	CHANGE	PAGES AFFECTED
C	1-15-66	Fitz-patrick	Revised by incorporating SCN's 1 thru 15 and the following changes; added MIL-HDBK5 to Military Publications and	All

33-200

A 700-1 (REV. 1-62)

GENERAL DYNAMICS | CONVAIR

REVISIONS				
NO.	DATE	BY	CHANGE	PAGES AFFECTED
C	(Cont)	Fitz-patrick	MIL-STD-1247 to Military Documents; Changed Convair Document 69-00201 to 69-00201A; and deleted "minimum" from Countdown and Flight Reliability Goals. Added Table III. SPECS [signature] 5-4-66 [signature] 7-19-66 [signature] QA 5-30-66 [signature] 5-25-66 APPROVED BY AFSSD - SSVZC/Lt. Ambrush, dated 6 May 1966 and amended by AFSSD letter dated 28 June 1966. 7/19/66	

A 731-1 (REV. 3-62)

GENERAL DYNAMICS
Convair Division

1. SCOPE: This specification covers the following launch vehicle:

United States Air Force Model SLV-3
GD/C Model 69
Atlas Standard Launch Vehicle
Utilizing a MA-5 Rocket Engine System
(North American Aviation, Inc.)

The Atlas Standard Launch Vehicle (see 6.2) consists of a basic launch vehicle and mission peculiar kits, supplied by Convair Division of General Dynamics (GD/C) as Government Furnished Equipment for installation and test by GD/C (see 3.1.1).

1.1 MISSION: The Launch vehicle shall be used as a standard Launch Vehicle (SLV-3) to boost an upper stage and payload into a predetermined trajectory as required by the applicable addenda of this specification.

2. APPLICABLE DOCUMENTS:

2.1 The following documents form a part of this specification to the extent specified herein. Documents not identified by revision letter, date or amendment shall be of the latest issue in effect. For equipment designed or produced under Contract AF04(695)-710, the applicable issue of the following government agency documents shall be determined by Report GDA-CHA65-002.

SPECIFICATIONS

Federal

PPP-T-0060a 30 November 1961	Tape, Pressure Sensitive Adhesive, Waterproof-for Packaging and Sealing

Military

MIL-P-116D 29 September 1960	Preservation, Methods of
MIL-B-121B 21 May 1959	Barrier Material, Greaseproofed, Waterproofed, Flexible
MIL-D-3464B 31 October 1955	Desiccants, Activated, Bagged, Packaging Use and Static Dehumidification
MIL-P-3803 5 September 1952	Plastic, Polyethylene Molded and Extruded Shapes, Sheets and Tubing
MIL-B-5087A(ASG) 30 July 1954	Bonding; Electrical (For Aircraft) (for old design)

GENERAL DYNAMICS
Convair Division

2. APPLICABLE DOCUMENTS: (Cont)

MIL-B-5087A(ASG)(1) 29 January 1958	Bonding; Electrical (for Aircraft) (phase in 6 June 1960 for new design)
MIL-P-5518B 10 May 1956	Pneumatic Systems; Design, Installation and Tes s in Aircraft
MIL-H-5606A 21 February 1957	Hydraulic Fluid Petroleum Base, Aircraft and Ordnance
MIL-N-6011 14 March 1950	Nitrogen, Liquid and Gas
MIL-E-6051C 17 June 1960	Electrical-Electronic System Compatibility and Inter- ference Control Require- ments for Aeronautical Weapon Systems, Associated Subsystems and Aircraft.
MIL-H-6083B 18 July 1957	Hydraulic Fluid, Petroleum Base, Preservative
MIL-L-6880B(ASG) 25 August 1954	Lubrication of Aircraft, General Specification for
MIL-W-8160B 19 July 1957	Wiring, Guided Missile, Installation of; General Specification for (for old design)
MIL-W-8160D 17 March 1961	Wiring, Guided Missile Installation of; General Specification for (phase in 25 September 1962 for new design)

GENERAL DYNAMICS
Convair Division

2. APPLICABLE DOCUMENTS: (Cont)

MIL-I-8500B 10 October 1960	Interchangeability and Replaceability of Component Parts for Aircraft and Missiles
MIL-M-8555 31 December 1952	Missiles, Guided: Design and Construction, General Specification for
MIL-E-25366A 28 June 1957	Electric and Electronic Equipment and Systems, Guided Missiles, Installation of, General Specification for old design
MIL-E-0025366B(USAF) 18 August 1958	Electric and Electronic Equipment and Systems, Guided Missiles, Installation of, General Specification for (phase in 10 November 1959 for new design)
MIL-H-25475 26 June 1956	Hydraulic Systems: Design Installation, and Tests in Missiles (General Specification for old design)
MIL-H-25475(USAF)(2) 4 May 1960	Hydraulic Systems: Design Installation, and Tests in Missiles (General Specification for))phase in 15 August 1960 for new design)
MIL-P-25508C(USAF) 7 November 1960	Propellant, Oxygen
MIL-R-25576B 23 January 1959	Rocket Fuel, RP-1
MIL-P-27401A 7 November 1960	Propellant, Pressurizing Agent, Nitrogen

GENERAL DYNAMICS/CONVAIR
Convair Division

2. APPLICABLE DOCUMENTS: (Cont)

General Dynamics/Convair

AB63-0072A 9 October 1964	SLV-3/Agena D Interface Requirements Specification (U)
0-75001	Permissible Contamination Limits, Fuel System Components
0-75002	Permissible Contamination Limits, Liquid Oxygen System Components
0-75035	Permissible Contamination Limits, Pneumatic System Components
0-75069	Contamination Limits and Evaluation Methods, Hydraulic Systems-Specification for
7-00004	Finish Specification for WS-107A
7-00209 B 1 March 1958	Environmental Design Conditions and Environmental Test Procedures for WS-107A-1 Equipment, Specification for
27-00004	Protective Finish for Airborne, Aerospace, Ground and Ground Electronic Equipment, Specification for
27-03540 B 18 March 1964	Subsystem-First Stage Separation, Space Programs, Vehicleborne Specification for
69-00160D 14 December 1965	Detail Specification, Basic Launch Vehicle, Atlas Standard Launch Vehicle, SLV-3

GENERAL DYNAMICS/[illegible] REPORT NO.
Convair Division

2. APPLICABLE DOCUMENTS: (Cont)

69-00161A 12 August 1964	MOD III G Guidance Kit, Standard Launch Vehicle, (SLV-3), Specification for
69-00162B 13 December 1963	Mark II Guidance Kit, Standard Launch Vehicle (SLV-3), Specification for
69-00164D 6 May 1966	Electrical Distribution Box Kit, Standard Launch Vehicle, SLV-3, Specification for
69-00165E 1 March 1966	Autopilot Kit, Standard Launch Vehicle (SLV-3), Specification for
69-00169E 17 December 1965	Telemetry Kit, Standard Launch Vehicle, SLV-3, Specification for
69-00179 12 January 1965	Range Safety Command Receiver Kit, Standard Launch Vehicle SLV-3, Specification for
69-00201A 25 June 1965	Structural Design Criteria Specification-Atlas, Standard Space Launch Vehicle SLV-3B
69-00202D 11 October 1965	Environmental Design and Test Criteria Specification for Space Launch Vehicles (SLV-3) Vehicleborne and Aerospace Ground Equipment
69-01006E 5 January 1966	Subsystem-Telemetry (Transmitting Set No. 1), Standard Launch Vehicle, Vehicleborne, SLV-3, Specification for

GENERAL DYNAMICS/CONVAIR
Convair Division

2. APPLICABLE DOCUMENTS: (Cont)

69-01009C 29 December 1965	Subsystem-Telemetry (transmitting Sets No. 1 & 2), Standard Launch Vehicle, Vehicleborne, (SLV-3), Specification for
69-01676 28 March 1966	Prime Retro Rocket Kit, Specification for
69-01679 28 March 1966	Cableway Cover Kit, Standard Launch Vehicle, SLV-3, Specification for
69-01681 28 March 1966	Agena Adapter Kit, Standard Launch Vehicle, SLV-3, Specification for
69-02100C 28 February 1966	Subsystem-Propulsion, Atlas Standard Launch Vehicle, SLV-3, Vehicleborne, Specification for
69-03000D 7 February 1966	Range Safety Command, Subsystem, Standard Launch Vehicle (SLV-3) Vehicleborne Specification
69-03007A 9 July 1964	Subsystem-Mark II Guidance, Standard Launch Vehicle (SLV-3), Specification for
69-03008A 30 July 1964	Subsystem Mod III G Guidance, Standard Launch Vehicle (SLV-3), Specification for
69-04000E 1 March 1966	Subsystem, Autopilot, Atlas Standard Space Launch Vehicle (SLV-3), Specification for
69-04007A 9 July 1964	Subsystem-Propellant Utilization, Standard Launch Vehicle (SLV-3), Vehicleborne, Specification for

GENERAL DYNAMICS/CONVAIR
Convair Division

2. APPLICABLE DOCUMENTS: (Cont)

69-06301D 15 February 1966	Subsystem-Electrical, Atlas Standard Launch Vehicle, (SLV-3), Vehicleborne, Specification for
69-08000C 28 February 1966	Subsystem-Pneumatic, SLV-3 Vehicleborne, Specification for
69-08035 18 March 1966	Liquid Oxygen Tank Boiloff Valve Kit, Standard Launch Vehicle, SLV-3, Specification for
69-08036 18 March 1966	Liquid Oxygen Tank Boiloff Valve Kit, Standard Launch Vehicle (SLV-3) Prime Program, Specification for
69-08041 18 March 1966	Liquid Oxygen Tank Regulator and Relief Valve Kit, Standard Launch Vehicle, SLV-3, Specification for
69-08042 18 March 1966	Liquid Oxygen Tank Regulator and Relief Valve Kit, Standard Launch Vehicle, (SLV-3) Prime Program, Specification for
69-08509C 7 February 1966	Subsystem-Hydraulic, Atlas Standard Launch Vehicle, (SLV-3), Specification for

STANDARDS

Federal

FED-STD-102 10 January 1957	Preservation, Packaging, and Packing

2. APPLICABLE DOCUMENTS: (Cont)

Military

MIL-STD-129C 11 July 1960	Marking for Shipment and Storage
MIL-STD-130 4 March 1953	Identification Marking of U.S. Military Property (for old design)
MIL-STD-130A 8 September 1958	Identification Marking of U.S. Military Property
MIL-STD-143 15 June 1960	Specifications and Standards, Order of Precedence for the Selection of
MIL-STD-176 1 March 1955	Weight and Balance Data Reporting Forms for Guided Missiles
MIL-STD-1247 12 March 1963	Identification of Pipe, Hose, and Tube Lines for Aircraft, Missiles, Space Vehicles, and Associated Support Equipment and Facilities (Applies to AF04(695)-710 Contract only)

DRAWINGS

SBAMA

SM 65-R-130	Container, Shipping, Vernier Engine

General Dynamics/Convair

69-00001	Missile Assembly, SLV-3
69-00005	Exterior Markings

OTHER PUBLICATIONS

Military

AFBM Exhibit 58-20A 1 December 1960	Gas, Fluid and Electrical Conduit Line Identification for Use in Missile and Space Systems

2. APPLICABLE DOCUMENTS: (Cont)

ARDCM 80-1 1 March 1957	Handbook of Instructions for Aircraft Designers, Volume II, Guided Missiles
MIL-HDBK 5 March 1961	Metallic Material and Elements for Flight Vehicular Structures

USAF Technical Orders

21-SM65D-2J-2-6 15 March 1962	Job Manual-Missile Airframe Ground Transportation and Handling
21-SM65D-2J-2-9 1 March 1962	Job Manual-Missile Airframe Pressurization Air Transportation

Air Force-Navy Aeronautical Bulletins

ANA-BUL-438a 16 March 1959	Age Control for Synthetic Rubber Parts (for old design)
ANA-BUL-438C 15 February 1965	Age Control for Synthetic Rubber Parts (Phase in on 7-27-65 for new design)

General Dynamics/Convair

GDA-CHA64-022	Military Document Review Guide
GDA-CHA65-002 Section One 29 April 1965	List of Compliance Specifications and Documents for Contract AF04(695)-710
ZZK-63-005A 7 July 1964	Electromagnetic Interference Control Plan for SLV-3
69-00033 1 June 1963	Applicable Documentation and Deviations Thereto, Atlas Standard Space Launch Vehicle (Collection document only - not totally approved)

GENERAL DYNAMICS
Convair Division

2. APPLICABLE DOCUMENTS: (Cont)

69-92090*	Composite System Acceptance Test Procedure SLV-3, WTR
69-92091*	Composite System Acceptance Test Procedure (ETR)
69-92100*	Acceptance Test Plan Standard Launch Vehicles
69-92101*	Acceptance Test Plan Standard Launch Vehicles (ETR)
GD/C-BHM64-004	Landline Measurement List, SLV-3

* For Book Number see Applicable Addendum

GENERAL DYNAMICS
Convair Division

3. REQUIREMENTS:

3.1 CHARACTERISTICS: The launch vehicle shall consist of a one and one half stage booster. The configuration and performance of the launch vehicle shall be as specified below.

3.1.1 LAUNCH VEHICLE DRAWINGS: The general configuration of the launch vehicle is indicated on the three view drawing in figure 1. The major items in the equipment pods of the launch vehicle are indicated on the inboard profile drawings in figure 2. Detail configuration of the launch vehicle shall be in accordance with GD/C Drawing 69-00001. The launch vehicle shall consist of the following missile peculiar kits and basic launch vehicle.

3.1.1.1 MISSION PECULIAR KITS: Complete provision shall be made for installation of the following kits, (see applicable addendum for launch vehicle configuration.)

a. Electrical Distribution Box Kit: An electrical distribution box kit conforming to GD/C Specification 69-00164 shall be provided for the electrical subsystem to provide for wiring junctions without splicing. Internal wiring will be adapted for each mission.

b. Autopilot Kit: An autopilot kit conforming to GD/C Specification 69-00165 shall be provided for the flight control subsystem on each mission.

c. Mod IIIG Guidance Kit: A Mod IIIG guidance kit in accordance with GD/C Specification 69-00161 shall be provided to complete the guidance subsystem for all Eastern Test Range (ETR) programs.

d. Mark II Guidance Kit: A Mark II guidance kit in accordance with GD/C Specification 69-00162 shall be provided to complete the guidance subsystem for all Western Test Range (WTR) programs.

e. Telemetry Kit: A telemetry kit conforming to GD/C Specification 69-00169 shall be provided. The telemetry kit in conjunction with basic equipment shall form a TLM subsystem. The configuration of the telemetry kit will vary with the program.

GENERAL DYNAMICS CORP.
Convair Division

3. REQUIREMENTS: (Cont)

f. Range Safety Command Receiver Kit: A range safety command receiver kit conforming to GD/C Specification 69-00179 shall be provided. The kit in conjunction with basic equipment shall form a range safety command subsystem. The configuration of the range safety command receiver kit will vary with the program.

g. Agena Adapter Kit: An Agena adapter kit conforming to GD/C Specification 69-01681 shall be provided for vehicles intended for use with Agena upper stages. The installed kit shall provide for the connecting interfaces with the upper stage.

h. Liquid Oxygen Tank Regulator and Relief Valve Kit: A regulator and relief valve kit conforming to GD/C Specification 69-08041 shall be provided for conventional SLV-3 program launch vehicles.

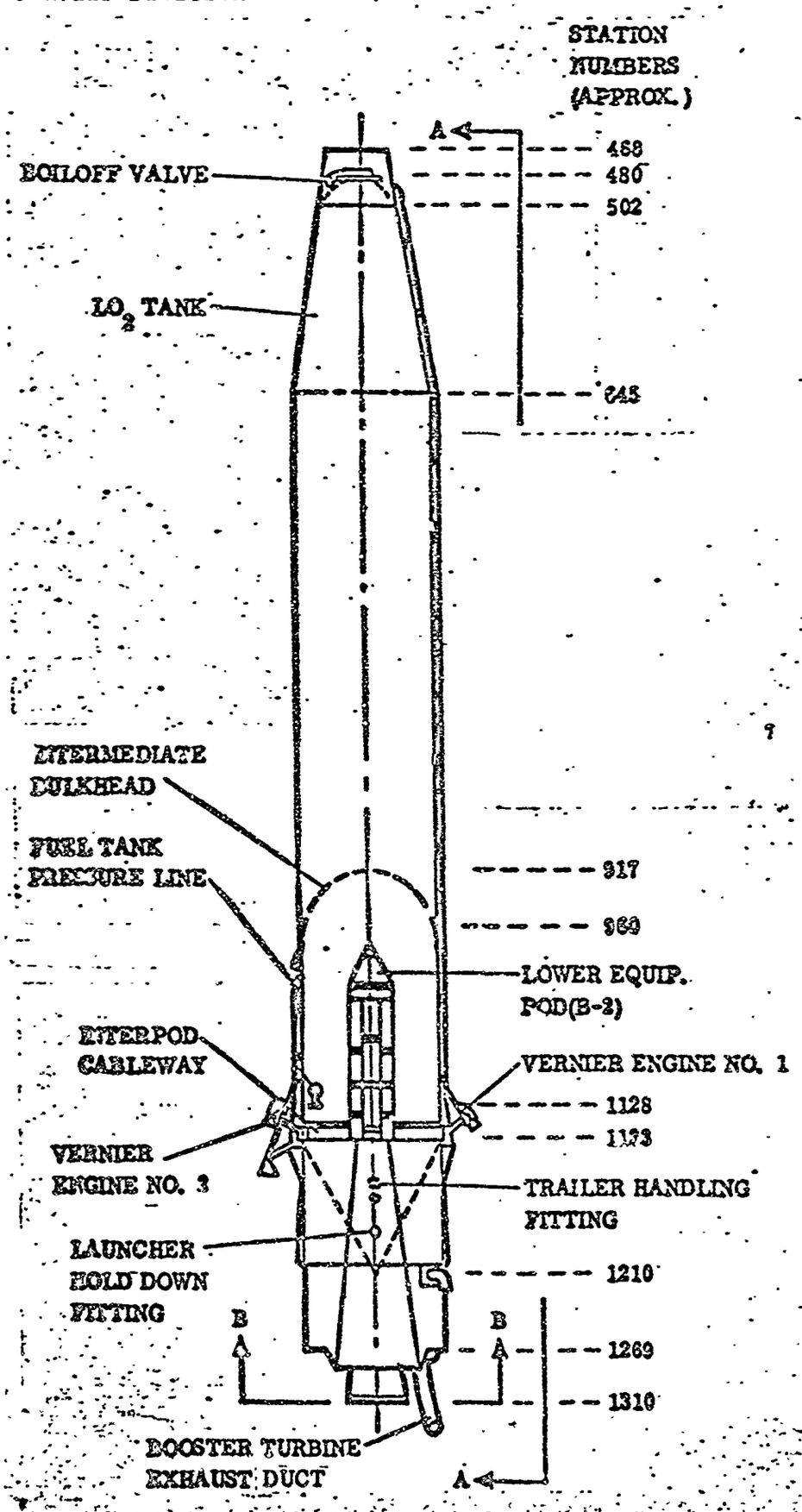
i. Liquid Oxygen Tank Regulator and Relief Valve Kit: A LOX regulator and relief valve kit conforming to GD/C Specification 69-08042 shall be provided for the PRIME Program Launch vehicles.

j. Liquid Oxygen Tank Boiloff Valve Kit: A Boiloff valve kit conforming to GD/C Specification 69-08035 shall be provided for conventional SLV-3 program launch vehicles.

k. Liquid Oxygen Tank Boiloff Valve Kit: A LOX boiloff valve kit conforming to GD/C Specification 69-08036 shall be provided for the PRIME Program launch vehicles.

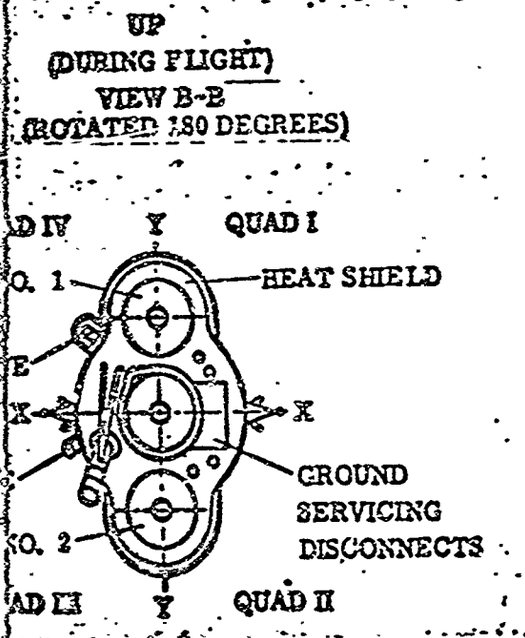
l. Retro Rocket Kit: A retro rocket kit conforming to GD/C Specification 69-01676 shall be provided for the PRIME Program launch vehicles.

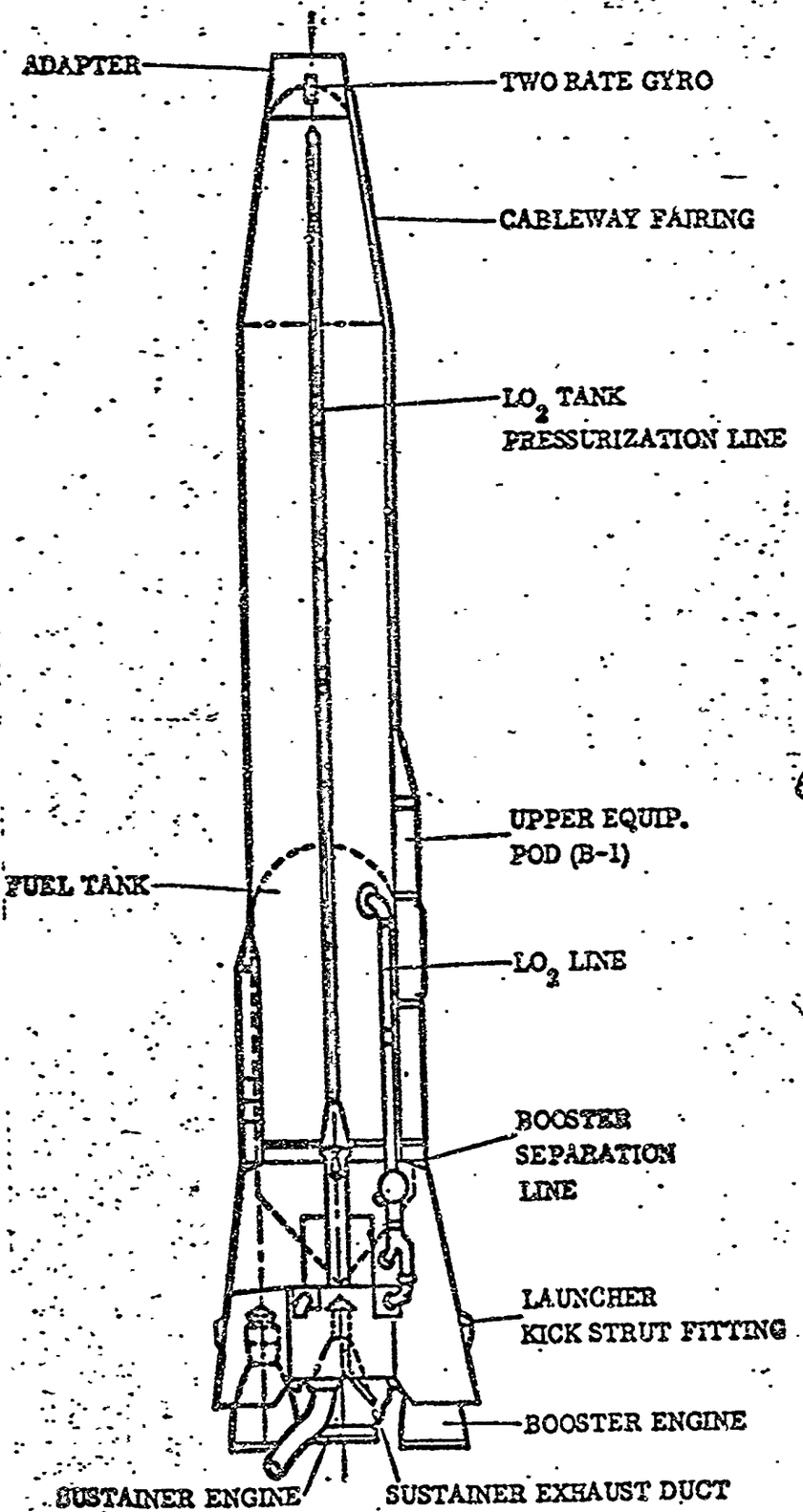
m. Cableway Cover Kit: A cableway cover kit conforming to GD/C Specification 69-01679 shall be provided for conventional SLV-3 programs.



PARAGRAPH 3.1.1, FIGURE

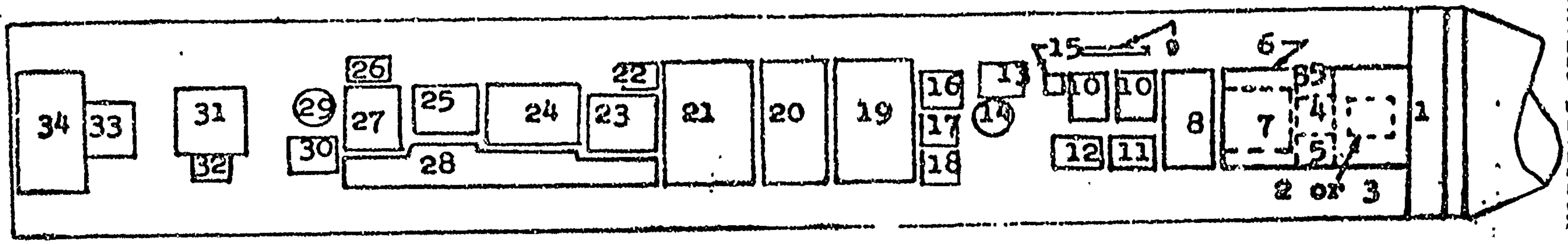
ONLY - NOT FOR INSPECTION





GURE 1 - THREE VIEW, STANDARD LAUNCH VEHICLE

NOTE: FOR REFERENCE ONLY - NOT FOR INSPECTION



1. Range Safety & Telemetry Antenna
2. Tee Coupler (with 1 transmitting set)
3. Ring Coupler (with 2 transmitting sets)
4. Pressure Transducer
5. Differential Pressure Switch
6. MKII Guidance Antenna (WTR Only)
7. TLM Transmitting Set No. 2
8. Inverter
9. Ground Plate
10. Range Safety Receivers (2)
11. Range Safety Ring Coupler
12. Range Safety Destructor
13. Range Safety Battery
14. Fuel Probe Outlet
15. Fuel Probe Disconnect
16. Power & Signal Control Unit (RSC)
17. Range Safety Arming Switch
18. Range Safety Battery
19. Autopilot Gyroscope
20. Autopilot Servoamplifier
21. Autopilot Programmer
22. Autopilot Staging Accelerometer
23. Propellant Utilization Computer Assy.
24. Electrical Distribution Box Kit
25. Power Changeover Switch
26. Autopilot Transformer
27. Main Battery
28. Instrumentation Area
29. Engine Relay Box
30. Telemetry Battery No. 1
31. TLM Transmitting Set No. 1
32. Accumulator Servicing Panel Installation
33. Pneumatic Inlet - Pod Cooling
34. Umbilical Panel
35. Telemetry Battery No. 2

Paragraph 3.1.1, - FIGURE 2a - Inboard Profile - Equipment Pod (B-1)

GENERAL DYNAMICS
Convair Division

3. REQUIREMENTS: (Cont)

3.1.1.2 BASIC LAUNCH VEHICLE: The basic launch vehicle is common to all SLV-3 missions and shall conform to GD/C Specification 69-00160. Appropriate kits specified above shall be added to the basic launch vehicle to form the flight vehicle.

3.1.2 PERFORMANCE: (See applicable addendum for performance of the launch vehicle.)

3.1.3 WEIGHT: The weight statement complies with MIL-STD-176 to which reference is made by line number in the applicable addendum. The launch vehicle weight shall consist of Government-furnished end items as indicated in the applicable addendum. Weights are nominal for trajectory purposes.

3.1.4 CENTER OF GRAVITY LOCATION: (See applicable addendum for expected vertical, lateral and longitudinal displacements versus time of flight.)

3.1.5 AREAS: Not applicable.

3.1.6 DIMENSIONS AND GENERAL DATA:

a. Body diameter: 120 inches

b. Body length: Approximately 850 inches

3.1.7 ENGINE CONTROL MOVEMENT: The maximum engine control movements shall be limited by mechanical and electrical stops.

3.1.7.1 MECHANICAL LIMITS: The mechanical engine control movement limits shall be as follows:

Engine	Plane	Minimum Angle Engine May be Gimbled and Held (exclusive of snubbing and overtravel) (degrees)
Booster	Pitch, Roll and Yaw	a. Total Excursion of $9.0^{+1.6}_{-0.0}$ b. From electrical null 4.9 ± 0.4

GENERAL DYNAMICS
Convair Division

3. REQUIREMENTS: (Cont)

3.1.7.1 MECHANICAL LIMITS: (Cont)

Engine	Plane	Minimum Angle Engine May be Gimbled and Held (exclusive of snubbing and overtravel) (degrees)
Sustainer	Pitch and Yaw	a. Total Excursion of $5.9^{+0.7}_{-0.0}$
		b. From electrical null 3.0 ± 0.3
Vernier	Pitch-Roll	a. Total Excursion of 140 ± 4
		b. From electrical null 70 ± 4
	Yaw	a. Total Excursion of 50 ± 1
		b. From electrical null (30 degrees) (1) Outboard 20 ±2 (2) Inboard 30 ± 2
		c. From electrical null (50 degrees) (1) Outboard 0 ± 1 (2) Inboard 50 ± 2

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Convair Division

3. REQUIREMENTS: (Cont)

3.1.7.2 ELECTRICAL LIMITS: The electrical limit for the engine control movement limits from the autopilot subsystem shall be in accordance with the Autopilot Subsystem Specification 69-04000.

3.1.7.3 ALLOWABLE OVERTRAVEL: Elastic overtravel of the engine due to being gimbaled to the mechanical limits at prescribed velocities shall not interfere with proper engine gimbaling.

3.2 GENERAL FEATURES OF DESIGN AND CONSTRUCTION: The launch vehicle shall be designed and constructed in accordance with Specification MIL-M-8555. The applicable portions of ARDCM 80-1, Volume II shall be used as a general design guide for the launch vehicle. (See Appendix II, items 57, 58, 60, 61, and 90 thru 93: section III pages 9 and 16; ECP's 7000-29, 7000-42 and 7000-68.)

3.2.1 SELECTION OF MATERIALS, PARTS AND PROCESSES: Materials, parts and processes shall conform to applicable specifications in accordance with Standard MIL-STD-143, and Handbook MIL-HDBK 5. Materials, parts and processes not covered by specifications or requirements specified herein shall be subject to the approval of the procuring activity. For Contract AF04(695)-710, the applicable specifications shall be selected from the list in Report GDA-CHA65-002.

3.2.2 PRODUCTION, MAINTENANCE AND REPAIR: The basic launch vehicle shall be a standardized configuration to facilitate components control and economical production. Platform type mounts shall be provided in the equipment pods to facilitate the expeditious addition, removal or repair of the various applicable kits required by specific programs. Special attention shall be directed towards facilitating the inspection and maintenance of standardized components, basic structure and applicable kits without sacrificing vehicle integrity. Routine maintenance shall be considered as periodic inspection, including the replacement of components which may ordinarily require replacement at such inspection intervals. The requirements for special tools shall be kept to a minimum.

3.2.3 INTERCHANGEABILITY AND REPLACEABILITY: The requirements of Specification MIL-I-8500 shall be applicable for the manufacture, interchangeability and replaceability of component parts used on the launch vehicle. (See Appendix II, ECP 7000-44).

GENERAL DYNAMICS
Convair Division

3. REQUIREMENTS: (Cont)

3.2.4 FINISHING: The finish for the launch vehicle and its components shall be in accordance with GD/C Specification 27-00004 for equipment designed for the SLV-3 program and 7-00004 for equipment common to other programs.

3.2.5 IDENTIFICATION AND MARKING: Identification and marking shall be in accordance with Standard MIL-STD-130. Exterior markings shall be in accordance with GD/C Drawing 69-00005. The fluid and gas lines shall be further identified in accordance with AFBM Exhibit 58-20 or MIL-STD-1247 (AF04(695)-710 Contract). All safety precautions shall be identified with contrasting color in a prominent location. Switches and adjustment devices shall be identified with appropriate markings alongside such switches and devices. Any removable access doors shall be marked with identification for replacement purposes. (See Appendix II, items 83; section III page 45).

3.2.6 EXTREME CLIMATIC AND ENVIRONMENTAL REQUIREMENTS: The launch vehicle shall be capable of operation within the performance requirements of this specification at ambient temperatures ranging between 0°F and 160°F, and shall not be adversely affected by other natural phenomena or environments encountered or inducted by operation within the specified temperature range. The launch vehicle components shall be capable of meeting the requirements of GD/C Specification 69-00202 or 7-00209 as indicated in the component specification (See Appendix II, section III, page 46).

3.2.7 NOISE AND VIBRATION REQUIREMENTS: The equipment shall function normally in all extremes of noise and vibration that will be encountered. The acceleration and vibration design requirements shall be in accordance with Specification 69-00202 or 7-00209 as indicated in the component specification. (See Appendix II, section III, page 46).

3.2.8 LUBRICATION: Lubrication of the launch vehicle shall be in accordance with Specification MIL-L-6880.

3.2.9 EQUIPMENT AND FURNISHING INSTALLATION: The equipment and furnishing specified in appendices I-A, I-B and I-C and as described in other portions of this specification shall be installed in the quantity and under the applicable conditions set forth.

GENERAL DYNAMICS
Convair Division

3. REQUIREMENTS: (Cont)

3.2.10 RELIABILITY:

3.2.10.1 RELIABILITY GOALS: Reliability goals for countdown and flight have been established as indicated below. Apportionment to the subsystem and reliability functional block level is expressed as a reliability number and mean cycles between failure (MCBF) as design goals for launch vehicles, subsystems and kits. These goals do not signify requirements to be demonstrated other than that pre-launch reliability is assessed against apportioned values through use of applicable test and checkout data and the Reliability Operational Model. (GD/C Report 63-0215 applies to Contracts AF04(694)-240 and AF04(695)-379, Table I and II. GD/C Report 63-0215A applies to Contract AF04(695)-710, Table II and III.)

TABLE I

	COUNTDOWN		FLIGHT	
	Reliability No. Target	MCBF Target	Reliability No. Target	MCBF Target
Launch Vehicle	0.98	50	0.93	14
Subsystems				
Airframe	-	-	-	-
Primary	0.99998	50,000	0.9998	5000
Auxiliary	0.9999	10,000	0.9987	769
Flight Control	0.9984	625	0.9800	50
GD/A Prop.	0.9989	909	0.9848	66
Electrical	0.99962	2,632	0.9906	106
Pneumatic	0.9922	128	0.9932	147
Hydraulic	0.9980	500	0.9838	62
Range Safety	0.9958	238	0.9950 *	200
Telemetry	0.9960	251	0.9915 *	117
Separation (Booster)	Not Applicable	Not Applicable	0.99961	2,564
Propellant Utilization	N/A	N/A	N/A	N/A
Propellant Level Control	0.9964	278	N/A	N/A

* Not required for successful flight.

GENERAL DYNAMICS
Convair Division

3. REQUIREMENTS: (Cont)

TABLE II

	COUNTDOWN		FLIGHT	
	Reliability No. Target	MCEF Target	Reliability No. Target	MCEF Target
Kits				
Basic Launch Vehicle (EID 69-1600)	0.9829	58	0.9491	20
Mod. IIIG Guidance Kit (GD/C supplied portion) (EID 69-1610)	0.9999	10,000	0.9999	10,000
Mark II Guidance Kit (GD/C supplied portion) (EID 69-1620)	0.9999	10,000	0.9999	10,000
Electrical Distribution Box Kit (EID 69-1640)	0.9999	10,000	0.9995	2,000
Autopilot Kit (EID 69-1650)	0.9992	1,250	0.9804	51
Telemetry Kit (EID 69-1690)	0.9991	1,111	0.9937	159

NOTE: Reliability numbers for additional kits of 3.1.1.1 will be added when available.

TABLE III

RELIABILITY TARGETS

	COUNTDOWN		FLIGHT
	WTR	ETR	
Launch Vehicle	0.94068	0.93430	0.97500
Subsystems			
Airframe			
Primary	0.99996	0.99994	0.99997
Auxiliary	0.99983	0.99978	0.99990
Flight Control	0.98570	0.98055	0.99082
Propellant	0.98242	0.98290	0.99473
Electrical	0.99632	0.99622	0.99575
Pneumatic	0.99218	0.99087	0.99792
Hydraulic	0.99899	0.99866	0.99570
Range Safety	0.99949	0.99927	0.99970*
Telemetry	0.98441	0.98441	0.94855*
Separation	- -	- -	0.99997
Cooling and Heating	0.99997	0.99997	- -

* Not required for successful flight.

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3. REQUIREMENTS: (Cont)

3.2.10.2 RELIABILITY/PERFORMANCE DEMONSTRATION: Countdown and flight reliability/performance demonstration will be as provided in the basic contract.

3.2.11 LIFE:

3.2.11.1 MAXIMUM PREACCEPTANCE OPERATION: The maximum allowable operating time or number of equivalent operating cycles that shall not be exceeded prior to acceptance of the launch vehicle by the procuring activity shall be as follows:

Component	Max. Preacceptance Operation
Main Missile Inverter	297 hrs (Accumulative)
Power Changeover Switch	450 cyc
Signal and Power Control Unit	270 hrs
TLM Transmitting Set	450 hrs
Gyro Package	800 hrs
Two Rate Gyro Packages	800 hrs
Programmer (A/P)	1800 hrs
Filter Servo Package	1800 hrs
G. E. Guidance	To be determined

3.2.11.2 AGE CONTROL FOR SYNTHETIC MATERIALS: Age controls for synthetic materials shall conform to ANA Bulletin 438, except that the pre-acceptance age period shall be applicable only to those items listed in Appendix III. The pre-acceptance age requirement for the items in Appendix III shall be 36 months (Note: The assemblies listed in Appendix III also have a maximum post acceptance age requirement period of 42 months from the date of the DD250 to the launch date).

3.2.12 ELECTROMAGNETIC INTERFERENCE: The launch vehicle shall not cause nor be susceptible to electromagnetic interference beyond the limits specified in MIL-E-6051 as implemented by GD/C Electromagnetic Interference Control Plan ZZK-63-005.

3.3 AERODYNAMICS: The launch vehicle shall have sufficient control stability to correct the effects of winds, wind shears and gusts by thrust vector control consistent with the structural limitations of the configuration. Smoothness of contour shall be provided to satisfy aerodynamic requirements.

3. REQUIREMENTS: (Cont)

3.3.1 STABILITY AND CONTROL: During powered flight, the aerodynamically unstable launch vehicle shall be provided with stability and control as specified in A/P Subsystem Specification 69-04000. An autopilot (in conjunction with a guidance system) shall direct the thrust vector inclination relative to the launch vehicle axis.

3.3.1.1 CENTER OF GRAVITY LIMITS: The maximum predictable lateral center of gravity displacements in the pitch and yaw planes at any time of flight shall not be of sufficient magnitude to require intentional off-center engine alignment to meet specific mission control requirements.

3.4 STRUCTURAL DESIGN CRITERIA: The launch vehicle shall be structurally designed in accordance with GD/C Specification 69-00201.

3.4.1 STRUCTURAL DESIGN WEIGHTS: The weights used for structural design shall be as specified in GD/C Specification 69-00201. The envelopes of these weights shall cover all reasonable variations in launch vehicle manufacture, environment, and mission, to insure adequate structure.

3.4.2 LOADS CRITERIA:

3.4.2.1 FLIGHT LOADS AND ENVIRONMENT: The structural design flight load criteria shall be as specified in GD/C Specification 69-00201. The envelope of the structural design trajectory shall cover all reasonable variations in temperature, weight, acceleration, and aerodynamic forces. The influence of staging and internal forces shall likewise be included.

3.4.2.1.1 POWERED FLIGHT: During powered flight, the launch vehicle shall withstand, in the longitudinal, lateral, and tangential direction, the static and dynamic loads originating from:

a. Propulsion forces

b. Pitch program maneuver

c. Control maneuvers generated by atmospheric disturbances as set forth in GD/C Specification 69-00201.

d. Booster engine shutdown and jettison disturbances

3. REQUIREMENTS:

3.4.2.1.1 POWERED FLIGHT: (Cont)

e. Sustainer engine shutdown disturbances

f. Guidance steering commands.

3.4.2.1.2 UNPOWERED FLIGHT: The launch vehicle shall not be required to maintain structural integrity following separation of the upper stage.

3.4.2.2 HANDLING INERTIA LOAD FACTORS: The inertia load factors for all ground handling conditions shall be as specified in GD/C Specification 69-00201.

3.4.3 DESIGN FACTORS OF SAFETY: Factors of safety shall be applied to limit loads and limit stresses to provide design loads and design stresses. The individual factors of safety used for design shall be as specified in GD/C Specification 69-00201.

3.4.4 LAUNCHING AND READINESS:

3.4.4.1 WIND PROVISIONS: The launch vehicle, during erection, while on the pad ready for launching, and during launching operations shall be capable of withstanding the static and dynamic loads originating from winds. The winds with gusts and associated dynamic excitation loads shall be considered equal to a static, steady state equivalent wind. The magnitude of these winds for each program shall be as specified in GD/C Specification 69-00201. The launch vehicle shall be suitable protected from winds during readiness periods.

3.5 BODY GROUP:

3.5.1 FORWARD SECTION: The forward section shall consist of an adapter which shall attach the Government-furnished upper stage to the forward tank portion of the midsection. The forward section shall also contain the forward rate gyro and the electrical interface plug for the upper stage. Jettison fittings which connect upper stage equipment to the midsection shall be contained in the forward section. Alignment and interface requirements between the launch vehicle and the upper stage shall be as specified in GD/C Specification AE 63-0072.

3.5.2 MIDSECTION: The midsection shall consist of:

a. Propellant tanks

b. Equipment pods

c. Propellant flow lines

d. Tank pressurization lines

e. Electrical and plumbing fairing

f. Vernier engines

g. Vernier engine fairings

3. REQUIREMENTS: (Cont)

3.5.2 MIDSECTION: (Con

h. Sustainer engine

i. Helium bottle

j. Start and vernier propellant tanks.

k. P.U. Stillwells

3.5.2.1 PROPELLANT TANKS: The propellant tanks shall contain forward and aft compartments. The forward tank shall be used for liquid oxygen and the aft compartment shall be used for fuel. An intermediate bulkhead shall separate these compartments.

3.5.2.1.1 DESIGN AND CONSTRUCTION: The propellant tanks shall be designed as a thin walled monocoque structure, utilizing internal gas pressure to provide rigidity. The skin of the tank shall be of welded stainless steel. The tank shall have a total space volume of approximately 4060 cubic feet; 2503 cubic feet in the forward compartment and 1557 cubic feet in the aft compartment. For inspection purposes, accessibility to these compartments shall be by means of access doors, one located in the forward bulkhead and one at the end of the tail cone of the aft tank section. The forward end of the tank section shall be designed to engage and support a Government-furnished upper stage and adapter.

a. ANTIVORTEX BAFFLES: The LOX tank shall be provided with four equally spaced, triangular shaped membranes in a longitudinal position between the intermediate bulkhead and the tank wall. The fuel tank shall be provided with two disc shaped membranes located in the aft end of the cylindrical tank section and one in the conical portion of the tank.

b. ANTISLOSH BAFFLES: Annular rings shall be spaced approximately 10 inches apart in the aft end of the LOX tank to provide for antislosh protection to the tank.

c. PROPELLANT UTILIZATION SENSORS: Propellant Utilization sensors, located on Stillwell assemblies shall be provided in both tanks along the tank centerline to provide the fuel and LOX levels to the propellant utilization computer.

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3. REQUIREMENTS: (Cont)

3 5.2.2 EQUIPMENT PODS: Two external equipment pods, diametrically opposite each other along the Y-Y axis, shall be attached to the tank section.

3.5.2.2.1 DESIGN AND CONSTRUCTION: These equipment pods shall consist of a series of rigid doors, hinged parallel to the airstream, to suitably cover various items of equipment housed therein. The equipment shall be mounted in each pod as shown in figure 2. The larger (upper) pod shall be located between quadrants I and IV, and the smaller (stub) pod shall be located between quadrants II and III at approximately station 1133.0. External cableways shall be provided for interpod rf, power, and telemetering connections.

3.5.2.3 PROPELLANT FLOW LINES:

3.5.2.3.1 LOX FLOW LINE: An external propellant LOX flow line shall be provided for loading operations and to allow the flow of liquid oxygen from the tank section to the booster and sustainer LOX pump inlets.

3.5.2.3.1.1 DESIGN AND CONSTRUCTION: The external LOX flow line shall be 40 degrees removed for the X-X axis in quadrant IV and shall extend rearward from the aft end of the forward compartment of the tank section, parallel to the aft compartment of the tank section, into the booster and sustainer LOX pump inlets.

3.5.2.3.2 FUEL FLOW LINE: Booster and sustainer engine fuel flow lines, located inside the thrust section compartment, shall be provided for the flow of fuel from the tank to the engines. The booster engine fuel flow line shall also be used for loading operations.

3.5.2.3.2.1 DESIGN AND CONSTRUCTION: The internal fuel flow lines, one to the sustainer engine and one to the booster engines shall extend rearward from the tank conical section connectors in quadrant IV to the booster and sustainer fuel pumps.

3.5.2.4 TANK PRESSURIZATION LINES: Pressurization and sensing lines external to the tank shall be provided; one each for pressurizing the liquid oxygen tank and the fuel tank.

3. REQUIREMENTS: (Cont)

3.5.2.4.1 DESIGN AND CONSTRUCTION: The oxidizer pressurization line shall extend forward from the propulsion section, along the tank section (X-axis, quadrants III and IV) to a point aft of the forward bulkhead and into the forward compartment. The fuel pressurization line shall extend forward from the propulsion section into the aft compartment. (See 3.11.3.1.1)

3.5.2.5 ELECTRICAL AND PLUMBING FAIRING: An electrical and plumbing fairing shall be provided along the Y-axis of the launch vehicle between quadrants I and IV.

3.5.2.5.1 DESIGN AND CONSTRUCTION: The electrical and plumbing fairing shall accommodate the wiring and plumbing installation extending from the B-1 equipment pod to the area between the upper stage and the forward bulkhead of the tank section.

3.5.2.6 VERNIER ENGINES: The vernier engine thrust chambers shall be mounted, one opposite the other, upon the extreme aft periphery of the tank section along the X-X axis at approximate station No. 1128. The thrust chambers shall be located with the center of gravity located at approximately 73.3 inches from the Z axis, the normal thrust axis inclined 30 degrees to the longitudinal axis of the launch vehicle during the booster phase and 50 degrees during the sustainer phase. A hydraulic actuator, affixed to a bearing enveloping each shaft, shall rotate the shaft and chamber. Radiation and heat impingement shielding shall be installed to protect the structure from the heat that will be generated by the engines.

3.5.2.7 VERNIER ENGINE FAIRINGS: Vernier engine fairings shall be provided to ensure proper aerodynamic air flow around the vernier engines.

3.5.2.8 SUSTAINER ENGINE: The sustainer engine shall be gimbal-mounted to the sustainer thrust cone, approximate station No. 1210, and the sustainer thrust cone shall be rigidly mounted to the aft end of the fuel tank. Thrust chamber displacement shall be provided through the use of hydraulically operated gimbaled actuators.

3.5.2.9 START AND VERNIER PROPELLANT TANKS: Oxidizer and fuel start tanks shall start all engines. The tanks shall also provide propellant for vernier engine solo operation after sustainer engine cutoff.

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3. REQUIREMENTS: (Cont)

3.5.2.10 HELIUM BOTTLE: A helium bottle shall be provided for starts and vernier engine propellant tank pressurization and engine pneumatic control functions. Helium will be stored at ambient temperatures.

3.5.3 AFT SECTION: The aft section shall attach to the aft end of the midsection and shall be jettisoned during flight. The booster thrust structure shall accommodate engine and accessory mounting, part of main propellant tank, helium pressurization bottles, ground servicing and launching equipment. The aft section shall consist of the following in addition to the associated support equipment:

a. Booster Engines

b. Booster Thrust Structure

3.5.3.1 BOOSTER ENGINES: The booster engines, with the exception of the thrust chambers, shall be rigidly mounted to the booster thrust structure. The thrust chambers shall be independently gimbal-mounted upon the aft end of the booster thrust structure along the Y-Y axis at approximately station 1212.0. Hydraulically operated gimbaled actuators shall be mounted to the booster thrust structure and attached to each thrust chamber to provide thrust chamber displacement. The engine actuators shall be offset in roll by 0.11 degree ±0.08 degree in a CCW direction as viewed from aft. Propellant line connections to the thrust chambers shall provide for flexibility.

3.5.3.2 BOOSTER THRUST STRUCTURE: The booster thrust structure shall consist of a thrust cylinder, nacelles, and fairing forming a single compartment to house portions of the propulsion, pneumatic and separation subsystems. Heat shields shall be provided to protect heat-critical areas.

3.5.4 AIRFRAME INSTRUMENTATION REQUIREMENTS: The subsystem shall contain provisions for remote monitoring of subsystem performance.

3.5.4.1 MEASUREMENTS: Currently implemented measurements and those measurements of a recurring nature are shown in Tables I and II. If implemented, instrumentation for each measurement shall fulfill the measurement range and instrument accuracy requirements specified.

TABLE I - - Telemetry Measurements

Meas. No.	Parameter Descr.	(2) Parameter Range	(1) Measurement Range	(3) Meas. Acc.
A743T	Ambient at Sustainer Inst. Panel	-50 to 550°F	-50 to 550°F	±30°F
A745T	Amb. at Sustainer Fuel Pump	-50 to 550°F	-50 to 550°F	±30°F
A481T	Interpod Cblwy Cover	40 to 1000°F	40 to 1000°F	±48°F
A489T	V1 Clamshell Cover	40 to 1000°F	40 to 1000°F	±48°F
A507T	Tnl Cover to Sta 505	40 to 1000°F	40 to 1000°F	±48°F
A508T	Tnl Cover at Sta 600	40 to 1000°F	40 to 1000°F	±48°F
A509T	Tnl Cover at Sta 745	40 to 1000°F	40 to 1000°F	±48°F
A960	B1 Gimbal Block Z	-2 to +10 g's	-2 to +10 g's	±0.6 g
A970	S Gimbal Block Z	-2 to +10 g's	-2 to +10 g's	±0.6 g
A1970	PB Mount Radial	-30 to +30 g's	-30 to +30 g's	±3 g's
A3360	Adapter Top Y Tang	-5 to +5 g's	-5 to +5 g's	±0.5 g
A3370	Adapter Bot Y Tang	-5 to +5 g's	-5 to +5 g's	±0.5 g
A3420	Aft Pod Top Y Tang	-20 to +20 g's	-20 to +20 g's	±2 g's
A3430	Aft Pod Bot Y Tang	-20 to +20 g's	-20 to +20 g's	±2 g's
A4480	A/P Programmer Radial	-30 to +30 g's	-30 to +30 g's	±3 g's
A7210	Inverter Pkg Radial	-30 to +30 g's	-30 to +30 g's	±3 g's
A7220	B1 Pod Aft Radial	-30 to +30 g's	-30 to +30 g's	±3 g's

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3.5.4.1 (Continued)

Meas. No.	Parameter Descr.	(2) Parameter Range	(1) Measurement Range	(3) Meas. Acc.
A7230	B1 Pod Dist Box Radial	-30 to +30 g's	-30 to +30 g's	±3 g's
A514P	Engine Compartment Press	0 to 15psia	0 to 15 psia	±0.8 psi
A874P	Heat Shield delta Press	-1 to +1 psid	-1 to +1 psid	0.1 psid
A875P	Heat Shield delta Press	-1 to +1 psid	-1 to +1 psid	0.1 psid
A876P	Heat Shield delta Press	-1 to +1 psid	-1 to +1 psid	0.1 psid
A3960	A/P Servo Flange Radial	-30 to +30 g's	-30 to ±30 g's	±3 g's
A3T	V2 Conduit Temp	40 to 1500°F	40 to 1500°F	±73°F
A414T	NAA P/N 550848 AMB	0 to 500°F	0 to 500°F	±25°F
A415T	NAA P/N 550848 Comp	0 to 400°F	0 to 400°F	±20°F
A416T	Heat Shield Q1 Aft	40 to 1800°F	40 to 1800°F	±88°F
A427T	Heat Shield Q1 Mid	40 to 1500°F	40 to 1500°F	±73°F
A444T	Heat Shield Q2 Aft	40 to 1800°F	40 to 1800°F	±88°F
A445T	Heat Shield Q2 Mid	40 to 1500°F	40 to 1500°F	±73°F
A450T	Heat Shield Q3 & 4 Aft	40 to 1800°F	40 to 1800°F	±88°F
A451T	Heat Shield Q3 & 4 Mid	40 to 1500°F	40 to 1500°F	±73°F
A453T	NAC Dr Seal Sta 1174	40 to 1500°F	40 to 1500°F	±73°F
A454T	Fuel Tk Skin Q3 S 965	40 to 1200°F	40 to 1200°F	±58°F
A456T	Fuel Tk Skin Q1 S 965	40 to 1500°F	40 to 1200°F	±58°F
A457T	B1 Pod Amb Sta 1050	0 to 200°F	0 to 200°F	±10°F
A459T	B1 Pod Cal Sta 1050	0 to 200°F	0 to 200°F	±10°F
A462T	B2 Pod Amb Sta 1080	0 to 200°F	0 to 200°F	±10°F
A463T	B2 Pod Cal Sta 1080	0 to 200°F	0 to 200°F	±10°F
A464T	B Sec Strut Q1 & 4 Amb	0 to 500°F	0 to 500°F	±25°F

3.5.4.1 (Continued)

Meas. No.	Parameter Descr.	(2) Parameter Range	(1) Measurement Range	(3) Meas. Acc.
A545T	Comp V2 Fair St 1118	0 to 800°F	0 to 800°F	±40°F
A546T	RQD Frg Sta 1131	40 to 1500°F	40 to 1500°F	±73°F
A547T	Pd Skn Q2 & 3 Sta 969	40 to 1600°F	40 to 1600°F	±78°F
A548T	LOX Tk Skn LO Q2-590	-320 to +40°F	-320 to +40°F	±18°F
A549T	LOX Tk Skn LO Q4-590	-320 to +40°F	-320 to +40°F	±18°F
A551T	LOX Tk Skn LO Q2-690	-320 to +40°F	-320 to +40°F	±18°F
A552T	LOX Tk Skn LO Q4-690	-320 to +40°F	-320 to +40°F	±18°F
A654T	B Sec Strut Q1 & 4 Comp	0 to 400°F	0 to 400°F	±20°F
A655T	B Sec Strut Q2 & 3 Amb	0 to 500°F	0 to 500°F	±25°F
A656T	B Sec Strut Q2 & 3 Comp	0 to 400°F	0 to 400°F	±20°F
A657T	V2 Clmshell Cvr Outsd	40 to 1500°F	40 to 1500°F	±73°F
A658T	V2 Clmshell Insd Stag	40 to 1500°F	40 to 1500°F	±73°F
A659T	V2 Clmshell Outsd Stag	40 to 1500°F	40 to 1500°F	±73°F
A660T	V2 Clmshell Cvr Insd	40 to 1500°F	40° to 1500°F	±73°F
A727T	LOX Tk Skn Hi Q2-590	40 to 1400°F	40 to 1400°F	±68°F
A728T	LOX Tk Skn Hi Q4-590	40 to 1600 F	40 to 1600°F	±78°F
A729T	LOX Tk Skn Hi Q2-690	40 to 1600°F	40 to 1600°F	±78°F
A730T	LOX Tk Skn Hi Q2-690	40 to 1600°F	40 to 1600°F	±78°F
A811T	Heat Shield Q1 Fwd	0 to 400°F	0 to 400°F	±20°F
A812T	Heat Shield Q2 Fwd	0 to 400°F	0 to 400°F	±20°F
A813T	Heat Shield Q3 & 4 Fwd	0 to 400°F	0 to 400°F	±20°F
T165T	Ref Junct Aft Bl Pod	0 to 200°F	0 to 200°F	±10°F
T168T	Ref Junct Tlm No. 2	0 to 200°F	0 to 200°F	±10°F
A543T	Amb V2 Eng Gmbl Post	0 to 800°F	0 to 800°F	±40°F

(1) Instrumentation or Transducer Range:
(2) Required Range to be Measured.
(3) Accuracy of System From Point of Measurement to Measurement Readout by AGE.

3. REQUIREMENTS:

3.5.4.1 (Continued)

TABLE II - Landline Measurements

Meas. No.	Parameter Descr.	Parameter Range	Meas. Range	Meas. Acc.

(None Required)

3.5.4.2 IMPLEMENTATION: Implementation of instrumentation requirements for telemetry shall be in accordance with GD/C Specifications 69-01006 and 69-01009. Implementation of instrumentation requirements for landlines shall be in accordance with requirements of 3.19.2.

3.5.4.3 SUBSYSTEM PERFORMANCE: Telemetry and landline instrumentation circuits and associated transducers shall be designed and installed so that normal and abnormal operating conditions of these circuits and transducers shall not cause anomalous performance of the subsystem.

3.6 LIFT AND CONTROL SURFACES DEVICES: The launch vehicle has no aerodynamic lift or control surfaces. The propulsion subsystem of the launch vehicle shall provide sufficient thrust to lift the complete flight vehicle. Thrust vector directional control shall be obtained by means of hydraulic actuators, which shall move the engine thrust chambers through the required angles upon signal from the autopilot or guidance equipment.

3.6.1 ROLL CONTROL: Roll control during the booster stage shall be obtained by means of differential angular deflection of the booster and vernier engine thrust chambers located in the aft section. After staging, the vernier thrust chambers shall control roll.

3.6.2 PITCH AND YAW CONTROL: Lateral control during the first stage shall be obtained by the angular displacement of two gimbaled booster thrust chambers located in the aft section. Lateral control after staging shall be obtained by the angular displacement of a gimbaled sustainer thrust chamber located in the aft section on the launch vehicle centerline. Additional control shall be obtained from the vernier thrust chambers during the first seven seconds of the sustainer stage. During the vernier stage, lateral control shall be obtained from the vernier thrust chambers only.

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3. REQUIREMENTS: (Cont)

3.7 FLIGHT CONTROL SUBSYSTEM: The airborne flight control subsystem shall provide stabilization and steering of the launch vehicle during the one and one half stages of flight ending with vernier engine cutoff. Control of the launch vehicle shall be accomplished by means of a preset programmed automatic pilot and hydraulically powered actuators working in conjunction with the guidance package. The autopilot shall be capable of trimming out disturbing effects of winds, wind shears, and gusts by variable thrust vector control which produces angular displacement of the gimbaled thrust chambers on the booster, sustainer, and vernier engines.

3.7.1 AUTOPILOT: Design and performance characteristics of the autopilot shall be in accordance with GD/C Subsystem Specification 69-04000. The autopilot shall consist of the following equipment:

a. A preset flight programmer

b. Three rate and three displacement gyros which will sense the rate and amount of angular displacement in the pitch, yaw, and roll axes

c. Electronic filter servo amplifier package

d. Accelerometer switch to generate staging backup

e. Excitation transformer

3.7.1.1 FLIGHT PROGRAMMER: A preset flight programmer shall provide signals to initiate the following operations:

a. The programmed flight path about the pitch axis

b. Sequence switching: Includes the following major switching functions: enable guidance steering, enable staging, booster cutoff, sustainer cutoff, and vernier cutoff, and sequence discrete signals to the upper stage as specified in GD/C Specification AE63-0072.

c. The reference change about the roll axis

3.7.1.2 RATE AND DISPLACEMENT GYROS:

3. REQUIREMENTS: (Cont)

3.7.1.2.1 RATE GYROS: Pitch, yaw, and roll rate gyros shall be provided for use in sensing and damping the launch vehicle's angular motions.

3.7.1.2.2 DISPLACEMENT GYROS: The displacement gyros shall sense the angular displacement of the launch vehicle about the pitch, yaw, and roll axes. These gyros shall deliver output signals proportional to launch vehicle displacements from given reference axes.

a. Pitch: The pitch position reference element shall be orientated by means of an electrical signal from the programmer, according to a predetermined flight program, or by the guidance package, as specified in the associated contractor's specification.

b. Yaw: The yaw reference element shall be orientated by means of an electrical signal from the guidance package.

c. Roll: The roll reference element shall be orientated by means of an electrical signal from the programmer which shall be remotely set from an external source (AGE).

3.7.1.2.3 SPIN MOTOR DETECTORS: In order to verify the correct operation of the rate and displacement gyros prior to launch, a spin motor monitoring capability shall be incorporated.

3.7.1.3 FILTER SERVO PACKAGE: The filter servo amplifier package contains the pitch, yaw, and roll filters and the ten servo amplifiers and their associated electronic equipment. The function of this package is to accept input signals from the gyro package, filter the signals, and provide position command signals to the hydraulic controllers. An integrator is provided to compensate for steady-state system errors.

3.7.1.4 EXCITATION TRANSFORMER: The excitation transformer shall transform 115 volts rms 400 cps to 20 volts rms and 12 volts rms. The 20 volts rms shall be for the excitation of sustainer feedback transducers. The 12 volts rms shall be for the excitation of booster and vernier feedback transducers, and the vernier bias signal.

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3. - REQUIREMENTS: (Cont)

3.7.1.5 STAGING ACCELEROMETER: The staging accelerometer shall provide a backup staging signal to the programmer in the event that the guidance discrete signal is not received and vehicle acceleration reaches that specified in 3.7.1.5 of the applicable addendum.

3.7.2 CONTROL EQUIPMENT: The flight control subsystem shall utilize the following equipment to execute the command signals furnished by the autopilot.

a. Electro-hydraulic servo valves

b. Rocket engine gimbaling actuators

c. Feedback transducers

d. Hydraulic flow limiter valves

3.7.2.1 SERVO VALVES: The servo valves shall be of the electrically operated type. The valves shall be actuated by electrical signals received from the filter servo package. The flow rates, response times, and resonant frequencies shall be commensurate with the launch vehicle requirements for stabilization and control.

3.7.2.2 ACTUATORS: The hydraulically operated actuators shall be mechanically connected to the rocket engine thrust chambers, and shall provide thrust chamber deflection around the gimbal point. The actuators shall be powered and regulated by the hydraulic servo valves. Bearing surfaces shall be designed to minimize friction loads.

3.7.2.3 FEEDBACK DEVICES: Feedback devices, or transducers, shall be attached to each hydraulic actuator and shall provide accurate information of the actuator positions to their respective amplifiers.

3.7.2.4 FLOW LIMITER VALVES: Hydraulic flow limiter valves shall be used in the control of the booster and vernier engines. The valves shall limit the flow of hydraulic fluid in the actuator cylinders in order to limit the thrust chamber angular velocity.

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3. REQUIREMENTS: (Cont)

3.8. GUIDANCE SUBSYSTEM: The guidance package (rate and pulse beacons, and decoder), and an antenna assembly shall comprise the major components of the guidance subsystem. The subsystem shall operate in conjunction with related ground station equipment to maintain closed loop control of flight trajectory. The function of the guidance subsystem shall be to determine the azimuth, elevation and velocity of the vehicle and to furnish pitch and yaw steering commands, and discrete commands to fulfill the flight objective. The subsystem design and performance shall be in accordance with the following specifications:

1. ETR Guidance - GD/C Subsystem Specification 69-03008

2. WTR Guidance - GD/C Subsystem Specification 69-03007.

3.8.1 RATE BEACON: The rate beacon shall be capable of receiving a continuous wave (Mark II, L-band (WTR); Mod IIIG, X-band (ETR) signal and returning a continuous wave (Mark II, S-band; Mod IIIG, X-band) signal to the ground station. This rf closed loop operation shall provide the rates of change of the velocity vectors as determined by means of the doppler shift. The rate beacon operates independently from the pulse beacon and decoder.

3.8.2 PULSE BEACON: The pulse beacon shall be capable of receiving an X-band signal from the position tracking radar (ground based). The received signal shall be demodulated, amplified and then forwarded to the decoder.

3.8.3 DECODER: The decoder shall be capable of analyzing the message received from the pulse beacon as to message completeness and proper pulse spacing. The message shall then be translated into pitch and yaw steering analog signals and discrete command signals which are used as intelligence to the autopilot, engine relay box and the upper stage.

3. REQUIREMENTS: (Cont)

3.8.4 ANTENNA ASSEMBLY: The antenna assembly shall be capable of both radiating rf energy to a ground receiving station and receiving rf energy radiated from a ground station. The antenna assembly for WTR (Mark II) shall have an antenna located in each equipment pod. The antenna assembly for ETR (Mod IIIG) shall consist of one antenna located in the B-2 equipment pod.

3.9 ARMAMENT: Not applicable.

3.10 PROPULSION:

3.10.1 GENERAL DESCRIPTION AND COMPONENTS: Launch vehicle propulsion shall be attained by the use of a booster engine with two thrust chambers that have a total nominal sea level thrust of 330,000 pounds, a sustainer engine with a nominal sea level thrust of 57,000 pounds, and pump fed vernier engines with two thrust chambers, that have a total nominal sea level thrust of approximately 1,340 pounds. Requirements for the propulsion subsystem shall be in accordance with GD/C Subsystem Specification 69-02100.

a. Booster Engines: The booster engines shall provide the major portion of the launch vehicle initial thrust as well as directional and attitude control. The thrust chambers and associated accessories shall be jettisoned at staging.

b. Sustainer Engine: The sustainer engine shall provide straight line thrust during the booster phase as directed by the autopilot. After staging, the sustainer engine shall remain attached to the launch vehicle, providing directional and attitude control (until sustainer cutoff) in addition to thrust.

c. Vernier Engines: The vernier engines shall provide thrust during all phases of powered flight in addition to attitude and fine velocity control over certain phases of flight, as required by guidance. After sustainer engine cutoff, the vernier engines shall be capable of continuing solo operation for a period as long as 25 seconds.

d. Propellants: Engine propellants shall be liquid oxygen in accordance with Specification MIL-P-25508, and RP-1 type fuel in accordance with Specification MIL-R-25576.

3.10.1.1 PROPULSION SUBSYSTEM COMPONENTS: GD/C shall install the propulsion equipment to consist primarily of the following:

a. Thrust chambers

b. Propellant drive assembly
   (1) Propellant pumps
   (2) Turbine and gear drive assemblies
   (3) Gas generator
   (4) Exhaust ducting and heat exchanger
   (5) Pneumatic electrical control components
   (6) Gearbox lubrication equipment
   (7) Mounting structure

c. Electrical hydraulic control equipment

d. Main propellant control valves

e. High pressure flexible propellant lines

f. Thrust chamber gimbals

g. Liquid oxygen head suppression valve

h. Propellant utilization valve

i. Propellant starting equipment and tanks

j. Baffled injectors

k. Hypergolic ignition source for booster, sustainer, and vernier thrust chambers

l. Pyrotechnic ignition source for booster and sustainer gas generators

m. Engine relay box

GD/C shall provide equipment for propellant supply and utilization, inert gas purging, propulsion control, propellant filling and draining, and engine instrumentation, as well as make provisions for the installation, mounting, control, and servicing of the rocket engines. GD/C parts, assemblies, and surfaces having contact with RP-1 or LO_2 shall not exceed the contamination limits of GD/C Specifications 0-75001 and 0-75002, as applicable. Design and performance characteristics of the propulsion subsystem shall be in accordance with GD/C Subsystem Specification 69-02100.

3.10.1.2 EXHAUST PROVISIONS: The exhaust of the booster engine gas turbine shall be passed overboard through a heat exchanger located in a single exhaust duct. The heat exchanger shall be used for heating gaseous helium for main tank pressurization. The sustainer gas turbine exhaust shall be passed overboard through a single annular exhaust duct surrounding the sustainer thrust chamber.

3.10.1.3 FUEL PROVISIONS: Fuel shall be delivered from the main fuel tank to the inlets of the booster turbopumps through a shutoff valve, a jettison valve, flexible pipe or duct sections, and a manifold. The manifold shall direct the fuel flow to forward and aft turbopump fuel inlets. The equipment shall be mounted exterior to and aft of the fuel tank and, except for the fill and drain valve located exterior to the thrust structure, shall be enclosed by the propulsion section fairing and thrust structure. A separate delivery line and valve shall be provided to direct fuel from the tank to the sustainer turbopump fuel inlet.

3.10.1.3.1 INERT FLUID PREFILL: The booster engine thrust chamber fuel jackets shall be filled with an inert fluid prior to start to facilitate a "soft" engine thrust buildup.

3.10.1.4 POWER CONTROL: The electrically activated hydraulic and pneumatic valves provide the control for propulsion start, operate and stop. The booster engines shall be controlled pneumatically and the sustainer engine both pneumatically and hydraulically. The following launch vehicle components shall be actuated by the helium-gas-pressurized pneumatic lines:

a. Booster liquid oxygen control valves

b. Booster fuel control valves

c. Vernier propellant control valves

3.10.1.5 IGNITION: The thrust chambers shall be ignited with hypergolic ignition and the gas generators shall be ignited with pyrotechnic igniters.

3.10.1.6 LUBRICATION: Lubrication for the propulsion subsystem shall be supplied from two separate low pressure units, one for the booster engines and another for the sustainer engine. Each low pressure lubrication unit shall consist primarily of a tank, positive displacement type pumps, and associated plumbing. The tanks shall supply oil to oil pumps which shall discharge it to the oil jet lines. The oil stream shall be directed at the disengaging meshes of the turbopump gears and to the bearings, and shall then be ducted overboard.

3. REQUIREMENTS: (Cont)

3.10.1.7 OXIDIZER: The oxidizer shall be delivered from the main oxidizer tank to the inlets of the booster turbopumps through a line, shutoff valve, a jettison disconnect valve, and a manifold. The line, the body of the manifold, and the fill-drain valve shall be mounted externally. A separate delivery line running from a port on the retained portion of the staging disconnect valve shall be provided to direct oxidizer from the main oxidizer duct to the sustainer turbopump oxidizer inlet.

3.10.1.8 DRAINAGE PROVISIONS: The major portion of propellant drainage shall be accomplished through the lines and the fill and drain valves. Additional residual volumes shall be drained through separate connections. All connections shall be designed to minimize spillage in the interest of personnel safety and protection of equipment. Provisions shall be made for grounding the fuel and oxidizer lines to the launch vehicle structure before connecting or disconnecting.

3.10.1.9 PUMP AND DRIVE ASSEMBLY: There shall be a separate pump and drive assembly for each booster thrust chamber and a separate pump and drive assembly for the sustainer engine. Each pump and drive assembly shall consist of one oxidizer pump, one fuel pump, and one turbine assembly. The turbine assembly is connected to the pumps by a gearbox. The working fluid for the booster engine turbines shall be supplied from a single gas generator, and the working fluid for the sustainer engine turbine shall be supplied from a separate gas generator. The pumps and gas generators are parts of the propulsion units described in 3.10.2 and 3.10.3.

3.10.1.10 SUSTAINER FUEL DEPLETION SWITCH: The sustainer fuel depletion switch shall be capable of shuting off the sustainer and vernier engines when sensing a pressure decay at the sustainer engine fuel manifold in the absence of a normal sustainer engine shutdown by flight control.

3. REQUIREMENTS: (Cont)

3.10.2 LAUNCH MAIN UNITS: The booster engines shall provide the main launch thrust and shall consist of:

a. Two independently movable thrust chambers

b. Two turbopump assemblies, powered by a common gas generator

c. A turbine exhaust system with integral heat exchangers

d. Thrust mounts

e. Controls

The booster engines shall be designed with engine disconnect points to permit ease of installation and removal. Sufficient access shall be allowed to facilitate inspection and maintenance.

3.10.3 SUSTAINING PROPULSION UNITS:

3.10.3.1 SUSTAINER ENGINE: The sustainer engine shall be a complete operating unit consisting of:

a. A movable thrust chamber

b. Turbopump assembly

c. Gas generator

d. Turbine exhaust

e. Gimbaled thrust mount

f. Controls

3.10.3.2 VERNIER ENGINES: The vernier engines shall be a complete operating unit consisting of:

a. Two independently movable, gimbaled thrust chambers, each mounted on its own mounting structure

b. Valves, lines and fittings

c. Common starting equipment

d. Controls

3. REQUIREMENTS: (Cont)

3.11 ELECTRICAL SUBSYSTEM: Design and performance characteristics of the electrical subsystem shall be in accordance with GD/C Subsystem Specification 69-06301 and Specification MIL-E-25366. The electrical subsystem shall be capable of supplying electrical power to all launch vehicle subsystems except Range Safety Command and Telemetry which shall have independent power sources. The electrical subsystem shall also supply power to all auxiliary motors and relays.

3.11.1 ELECTRICAL POWER SUPPLY: A vehicleborne type battery-pack shall furnish d-c power for flight operation as follows:

1. EID 69-1600-1 thru -6:
   18.3 ampere-hours minimum at 26.0 to 30.0 vdc

2. EID 69-1600-7 and on:
   23.0 ampere hour minimum at 26.5 to 30.0 vdc.

An inverter shall convert the d-c power to 115v ac, 400 cps for using subsystems.

The electrical subsystem shall be capable of operation during prelaunch checkouts and warmups by electrical power provided from an external ground source. The external power shall be routed to the launch vehicle's power changeover switch through ground terminal boxes, umbilical cables and connectors.

3.11.2 SWITCHING: A power changeover switch shall be provided to transfer from ground to vehicle power.

3.11.3 EQUIPMENT INSTALLATIONS: All electrical equipment shall be installed in accordance with Specification MIL-E-25366.

3.11.4 WIRING: Wiring shall be in accordance with Specification MIL-W-8160. (See Appendix II, items 33 thru 36, 39, 42, 44, 47, and 51; section III pages 15, 23, 24, 25, 40, 41, 42, 44, and 47; ECP 7000-53R1.)

3.11.5 BONDING: Bonding shall be in accordance with Specification MIL-B-5087.

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3. REQUIREMENTS: (Cont)

3.11.6 CONNECTORS:

a. Umbilical connectors: Umbilical connectors shall be provided for attaching the ground power and control wires. The connectors shall be provided with a positive release at or prior to launching.

b. Interface connectors; The vehicle shall contain all such interface connectors as may be required for electrical mating of the launch vehicle and the upper stage. The type and amount required shall be in accordance with GD/C Specification AE63-0072.

c. Equipment connectors: The vehicle shall contain all such equipment connectors as may be required for electrical mating of launch vehicle equipment and interconnecting cabling as may be required. The type and amount required shall be in accordance with equipment specifications.

d. Staging connectors: Autopilot and telemetry harnesses to the booster section shall be provided with staging disconnect connectors. The connectors shall be capable of disconnection during booster staging.

3.11.7 RELAYS: Relays, capable of operating satisfactorily under the launch vehicle environmental conditions, shall be in accordance with the requirements of Specification MIL-R-8555 and installed in accordance with Specification MIL-E-25366. (See Appendix , items 57, 58, 60, and 61; section III page 16, ECP 7000-29 and 7000-42.)

3.12 HYDRAULIC SUBSYSTEM: The hydraulic subsystem shall consist of separate airborne hydraulic systems for the booster and sustainer-vernier engines. The hydraulic subsystem shall provide operating pressure to position the engine thrust chambers for attitude and directional control. Electrical signals from the autopilot shall be transmitted to the hydraulic actuator assemblies which will impart angular displacement to the thrust chambers about their gimbaled axes at a rate and direction corresponding to the signals received. The two hydraulic systems shall have separate hydraulic pumps, fluid tanks, accumulators, valves, filters, hydraulic servocylinder assemblies (each consisting of actuating cylinder, servovalve, and variable reluctance feedback transducer) and connecting plumbing.

3. REQUIREMENTS: (Cont)

3.12 HYDRAULIC SUBSYSTEM: (Cont)

The accumulators shall augment the flow when short duration high flows in excess of pump capacities are required and shall absorb pressure surges. The hydraulic fluid tanks, pressurized from the fuel tank gas pressurization system shall compensate for leakage, fluid contraction or expansion, accumulator discharge, and pressure surges in the return lines. In addition, the sustainer vernier system shall also furnish hydraulic power for the sustainer engine hydraulic control package.

3.12.1 BOOSTER HYDRAULIC SYSTEM: The booster hydraulic system shall supply the operating pressure to position the booster thrust chambers. Four actuators shall impart angular displacement to the thrust chambers. Pitch and yaw control shall be obtained by angular displacement of the thrust chambers, while roll control shall be obtained by differentially displacing the thrust chambers. A hydraulic pump, mounted on the turbopump assembly and powered by the turbopump, shall supply fluid to the booster hydraulic system through a check valve and filter. The system shall be provided with two accumulators and one hydraulic fluid tank. The accumulators and pump rundown flow shall provide pressure to maintain the thrust chamber gimbal angle at null position during the staging sequence.

3.12.2 SUSTAINER-VERNIER HYDRAULIC SYSTEM: The sustainer-vernier hydraulic system shall supply the operating pressure to position the vernier thrust chambers and the sustainer thrust chamber. Six actuators shall impart angular displacement to the thrust chambers. The actuating cylinders for the sustainer thrust chamber shall hold the chamber stationary during booster phase and shall impart angular displacement to the thrust chamber during the sustainer phase for pitch and yaw control. The actuating cylinders for the vernier thrust chambers shall hold these chambers locked in pitch and yaw but free in roll during the booster phase; free them for pitch, yaw, and roll control for the first 6.7 seconds of sustainer phase, then lock them so that they are free for roll control only for the remainder of the sustainer phase. During the vernier phase, the vernier actuating cylinders shall impart angular displacement to the thrust chambers for pitch, yaw, and roll control.

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3. REQUIREMENTS: (Cont)

3.12.2 SUSTAINER-VERNIER HYDRAULIC SYSTEM: (Cont)

During sustainer engine firing, a hydraulic pump geared to the sustainer turbopump, shall supply fluid power to the sustainer-vernier hydraulic system. After sustainer engine cutoff, fluid power shall be delivered to the vernier actuators by means of accumulators and pump rundown flow. In addition, hydraulic pressure shall be provided to the sustainer engine hydraulic control package for the actuation of the propellant utilization, head suppression and gas generator valves.

3.12.3 HYDRAULIC SYSTEM REQUIREMENTS: The hydraulic subsystem and equipment shall be in accordance with Specification MIL-H-25475. Hydraulic fluid used by the subsystem shall be in accordance with Specification MIL-H-5606. The hydraulic subsystem shall not exceed the contamination limits of GD/C Specification 0-75069. Design and performance characteristics shall be in accordance with GD/C Subsystem Specification 69-08509. (See Appendix II, section III page 32.)

3.13 PNEUMATIC SUBSYSTEM: The subsystem shall receive, store and distribute helium to the propellant tanks, for engine controls and for booster separation.

3.13.1 PROPELLANT TANK PRESSURIZATION: The fuel tank pressurization subsystem shall provide helium at a pressure between 60.0 and 67.0 psi to the fuel tank during flight prior to booster staging. The oxidizer tank pressurization subsystem shall provide helium at a pressure between 28.5 and 31.0 psi to the oxidizer tank prior to booster staging. Each of these subsystems shall include a relief valve.

3.13.1.1 HELIUM STORAGE BOTTLES: Six titanium spheres capable of storing cold helium at 3000 psi nominal shall provide helium to the regulators during flight. A motor operated shut-off valve shall be provided in the helium storage lines to isolate the storage spheres from the regulators until use of stored helium is required. The stored helium shall be routed through a heat exchanger prior to pressure regulation.

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3.13.1.2 BOIL-OFF VALVE: A pressure relieving valve (boil-off valve) shall be provided on the liquid oxygen tank primarily to relieve excess boil-off during tanking.

3.13.1.3 INTERFACES: Pressurization for the hydraulic fluid tanks and the lube oil tanks shall be provided by the fuel tank pressurization subsystem.

3.13.2 ENGINE CONTROLS PNEUMATICS: A single titanium sphere storing helium at 3000 psi nominal at ambient temperature shall supply helium to the integrated start system regulator sustainer engine, liquid oxygen reference regulator and the booster pneumatic control regulator. This portion of the subsystem shall be independent of the propellant tank supply subsystem.

3.13.3 SEPARATION SUBSYSTEM PNEUMATIC SUPPLY: A single sphere, mounted in the booster section and independent of the propellant tank supply shall supply pressure to the separation subsystem. This sphere shall be initially charged to 3000 psi nominal.

3.13.4 PNEUMATIC SYSTEM REQUIREMENTS: The pneumatic subsystem shall conform to MIL-P-5518 and GD/C Specifications 69-08000 and 69-00160. Those portions of the pneumatic subsystem having contact with pressurization gases shall not exceed the contamination limits of GD/C Specification 0-75035 as implemented by the contamination tests of GD/C Specification 69-00160. (See Appendix II, Item 15, 18 through 23, Section II, Pages 11 and 12.)

3.14 ENVIRONMENTAL PROTECTION EQUIPMENT:

3.14.1 AIR CONDITIONING: The equipment pods and forward section adapter shall have ducts to provide for air conditioning from a ground source prior to launch.

3.14.2 ENGINE RADIATION SHIELDS: Engine heat shields shall protect various areas of the launch vehicle from heat radiated by engine exhausts.

3.15 LAUNCHING SUBSYSTEM:

3.15.1 LAUNCHING: The launch vehicle is self launching when the proper conditions are present. Ground based equipment shall be required to meet these conditions and to provide the engine start signal.

3.16 PROPELLANT CONTROLS:

3.16.1 PROPELLANT UTILIZATION SUBSYSTEM: The Acoustica propellant utilization system senses the propellant remaining at 6 positions in both the LOX and fuel tanks during flight. At each position, an error signal is generated to position the propellant utilization valve located in the fuel line to the sustainer engine. By this means, the sustainer engine burning mixture ratio is adjusted to correct the unbalance of the propellants in the tank with the objective of achieving simultaneous depletion of both propellants about a predetermined empty reference in accordance with GD/C Specification 69-04007.

3.16.2 PROPELLANT LOADING CONTROL EQUIPMENT: Propellant loading control equipment shall be provided to insure that a maximum volume of propellants is provided to the two main tanks during vehicle tanking commensurate with minimum ullage requirements. At engine start, the ullage shall be not less than 27 cu. ft. for the fuel tank and not less than 35 cu. ft. for the LO_2 tank. (At the termination of propellant tanking under phase II conditions, the ullage is approximately 20 cu. ft. for the fuel tank and approximately 21 cu. ft. for the LO_2 tank.) The propellant loading control criteria for gross tanking shall be 1545 cu. ft. ± 0.3 percent of fuel, and 2485 cu. ft. ± 0.4 percent LO_2.

Electronic circuitry shall supply termination signals for rapid loading and fine loading of fuel and liquid oxygen, as well as topping for liquid oxygen. The equipment shall consist of four fuel level transducers in the top of the fuel tank, four dual element liquid oxygen level transducers located in the top of the liquid oxygen tank, and cabling. The transducer shall provide loading data to ground-based loading equipment.

3.17 STAGING SUBSYSTEM: The jettisonable aft section shall be securely locked to the main body of the vehicle by a separation mechanism which will release the jettison section for separation, via the jettison tracks, at staging. Design and performance characteristics of the staging subsystem shall be in accordance with GD/C Subsystem Specification 27-03540.

3.18 RANGE SAFETY SUBSYSTEM: The airborne portion of the range safety equipment shall be installed to provide:

a. Vehicle destruction

b. Manual fuel cutoff for all engines (MFCO) (ETRonly)

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3. REQUIREMENTS: (Cont)

3.18 RANGE SAFETY SUBSYSTEM: (Cont)

c. Automatic fuel cutoff for the sustainer and booster engines only (AFCO)(ETR only)

The design and performance characteristics (including proper sequence for the above functions) of the range safety subsystem shall be in accordance with GD/C Subsystem Specification 69-03000 and Range Safety Command Receiver Kit Specification 69-00179 (where applicable).

3.19 INSTRUMENTATION

3.19.1 TELEMETRY SUBSYSTEM: The telemetry subsystem shall provide for the transmission of flight data to a ground receiving station. The subsystem shall be in accordance with Specification MIL-E-25366 and with GD/C Subsystem Specification 69-01006 for the 1 transmitter configuration, and GD/C Subsystem Specification 69-01009 for the 2 transmitter configuration. Flight data from the instrumentation voltage pickoffs and transducers of the functional subsystem shall be provided as inputs to the transmitter(s). The transmitters shall condition the inputs and shall transmit the signal on an rf carrier through the power divider and to the antenna assembly. The transmission shall be of the PAM/FM/FM type.

19.2 LANDLINE MEASUREMENTS: The launch vehicle shall be provided with landline instrumentation for the transmission of preflight data to ground recorders and monitors. The landline measurement numbers and parameters shall be as listed in GD/C Report GD/C-BHM64-004.

3.20 HANDLING AND SERVICING PROVISIONS:

3.20.1 VEHICLE: Provisions necessary for handling and servicing shall be incorporated in the design of all launch vehicles. Any provisions for handling shall be of a removable type or a type that will not have an undue adverse effect upon the launch vehicle's flight characteristics. An assembled launch vehicle or section shall have devices to enable handling equipment to be used in the transfer or placement of the launch vehicle or section. Proper points for the application of supporting loads shall be indicated if damage can occur through misapplication of such loads. Adequate exterior marking shall indicate launch vehicle centerline and axis as a measuring and leveling aid. The principal method of adjusting for such items as launch vehicle leveling and center of gravity corrections is a portion of ground support and shall be accomplished by adjustment of the support linkage.

3.20.2 GROUND: Provisions and equipment associated with the aerospace ground equipment, including design philosophy related to but not a physical part of the launch vehicle, shall be as specified in the contract.

3.21 PRELAUNCH READINESS AND CHECKOUT PROVISIONS:

3.21.1 ERECTION: The launch vehicle shall be capable of being transported by the handling trailer to the launcher installation for erection, checkout, servicing, countdown and launch.

3.21.2 CHECKOUT: All subsystems shall be capable of operation during prelaunch checkouts using electrical, hydraulic and pneumatic power furnished by external ground sources. Electrical signals shall be transmitted through umbilicals to control and monitoring panels located on the ground. Checkout shall be conducted by use of the aerospace ground equipment.

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4. QUALITY ASSURANCE PROVISIONS:

4.1 CLASSIFICATION OF TESTS: Inspection and testing of the launch vehicle shall be classified as acceptance tests. This specification does not make provisions for preproduction tests, production acceptance test and periodic revaluation test. When such tests are required, as outlined in the unified test plan, they shall be conducted as specified in the component or equipment specifications.

4.2 ACCEPTANCE TESTS: Acceptance tests shall consist of individual tests.

4.2.1 INDIVIDUAL TESTS: Each launch vehicle shall be subjected to the following tests as described in 4.4, "Test Methods" of this specification.

a.	Examination of product	See 4.4.1
b.	Acceptance test plan	See 4.4.2
c.	Weight	See 4.4.3
d.	Electromagnetic Interference Control	See 4.4.4

4.3 TEST CONDITIONS:

4.3.1 ATMOSPHERIC CONDITIONS: Unless otherwise specified herein, all tests required by this specification shall be performed at an atmospheric pressure of between 28 and 32 inches of mercury, a temperature of between plus 60°F and plus 95°F, and a relative humidity of not more than 90 percent. Where tests are performed with atmospheric conditions substantially different from the specified values, proper allowance for changes in instrument readings shall be made to compensate for the deviation from the specified conditions.

4.4 TEST METHODS:

4.4.1 EXAMINATION OF PRODUCT: The launch vehicle shall be examined visually and manually for compliance with 3.1 prior to any other tests to determine that the launch vehicle meets the requirements of workmanship, identification, marking, finish, dimensional requirements and cleanliness.

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4. QUALITY ASSURANCE PROVISIONS: (Cont)

4.4.2 ACCEPTANCE TEST PLAN: The launch vehicle shall be tested in accordance with GD/C Test Specification 69-92100 as implemented by the GD/C Composite Test Procedure 69-92090 when assigned to WTR. The launch vehicle shall be tested in accordance with GD/C Test Specification 69-92101 as implemented by GD/C Composite Test Procedure 69-92091 for all ETR launch vehicles.

4.4.3 WEIGHT: The launch vehicle total weight shall be checked to determine compliance with the requirements of the applicable addendum.

4.4.4 ELECTROMAGNETIC INTERFERENCE CONTROL (EMI): The launch vehicle shall be tested in accordance with the EMI requirements of Specification MIL-E-6051 as implemented by GD/C EMI Control Plan ZZK-63-005.

5. PREPARATION FOR DELIVERY:

5.1 CLEANING: Cleaning shall be accomplished in accordance with Specification MIL-P-116, process C-1.

5.2 DRYING: Drying shall be accomplished in accordance with Specification MIL-P-116, process D-4.

5.3 PRESERVATION AND PACKAGING: Unless otherwise specified by the procuring activity, preservation and packaging shall be in accordance with Specification MIL-P-116, to meet requirements for level C as specified in FED-STD-102, with the exception of the vernier engine assemblies which shall be preserved and packaged in accordance with SBAMA Instruction SM-65-R-130.

5.4 PACKING: Packing shall be accomplished to meet requirements of level C as specified in FED-STD-102.

5.5 PREPARATION FOR STORAGE: For vehicles contractually covered for 30 day indoor storage, the following procedures shall apply.

5.5.1 AIR FRAME:

5.5.1.1 DRAINS, FITTINGS AND VALVES: All exterior drains, fittings, valves and other openings shall be closed using unthreaded polyethylene plugs or caps, which shall be secured in place with tape conforming to Specification PPP-T-0060. Areas where covers have been removed to facilitate storage maintenance and all other irregular openings shall be covered with polyethylene sheet conforming to Specification MIL-P-3803, which shall be secured in place with tape conforming to Specification PPP-T-0060. Tape shall be applied to permit air circulation under covered areas.

5.5.1.2 DOORS: All doors shall be secured in place with attaching devices provided.

5.5.1.3 ELECTRICAL CONNECTORS AND RECEPTACLES: Unthreaded polyethylene caps shall be placed over connectors and receptacles and shall be secured in place with tape conforming to Specification PPP-T-0060.

5.5.1.4 EXTERIOR SURFACES: All exterior surfaces of the vehicle shall be cleaned in accordance with the requirements of Specification MIL-P-116, process C-1, and dried in accordance with process D-4 to remove all corrosion, and dust accumulation. All preservation coatings removed during the cleaning process shall be replaced.

5.5.2 HYDRAULIC SYSTEM: The following shall be accomplished on the hydraulic system before placing vehicle in storage:

a. Verify that hydraulic fluid in the system conforms to requirements of GD/C Specification 0-75069.

b. Check for external leakage and provide corrective action if leakage is observed.

c. Remove all pneumatic charge from accumulators and fluid tanks.

d. Retain 2½ pints of fluid ullage in the airborne hydraulic fluid tank.

5.5.3 PROPELLANT TANKS (INTERIOR): Tanks cleaned to meet requirements specified in section 3 shall be purged with nitrogen conforming to Specification MIL-P-27401. The dew point of the tanks shall not exceed plus 30 degrees F. Liquid oxygen tank pressurization for storage of vehicle shall be 2 to 5 psig; and fuel tank pressurization shall be 8 to 11 psig. Nitrogen for pressurization shall conform to Specification MIL-P-27401.

5.5.4 THRUST CHAMBER ACTUATING CYLINDER (BOOSTER, SUSTAINER AND VERNIER):

5.5.4.1 PISTON ROD:

a. Exposed portion of rod shall be cleaned in accordance with Specification MIL-P-116, process C-1, and a light coat of preservative liquid conforming to Specification MIL-H-6083 shall be applied.

b. Preserved area of rod shall be wrapped with barrier material conforming to Specification MIL-B-121, grade A, which shall be secured in place with tape conforming to Specification PPP-T-0060.

5.5.4.2 THRUST CHAMBER:

a. Thrust nozzle openings of booster, sustainer and vernier engines shall be secured with protective caps. Desiccant placed in area provided in cap shall conform to Specification MIL-D-3464.

b. Movement of the thrust chamber (booster and sustainer engines) shall be eliminated by installation of locking and securing devices provided. The vernier engines thrust chamber shall be secured to prevent free movement using tape conforming to Specification PPP-T-0060.

5.5.5 LIQUID OXYGEN FILL AND DRAIN DUCT PRESSURIZATION: The fill and drain duct pressure shall be raised and maintained above atmospheric pressure. Nitrogen used for pressurization shall conform to Specification MIL-P-27401. Only liquid oxygen compatible tubing or hose shall be used during pressurization.

5.5.6 CANISTERS: Canister shall be purged to the appropriate pressure and vacuum values for each canister, using nitrogen conforming to Specification MIL-N-6011. After purging, canisters shall be pressurized to the appropriate psig value and leak tested.

5.6 MARKING: Interior and exterior containers shall be marked in accordance with MIL-STD-129. This shall be interpreted to include all precautionary and special markings as applicable.

5.7 SPECIAL HANDLING, LOADING TECHNIQUES AND DEVICES:

5.7.1 AIR TRANSPORTATION: Transportation of the vehicle by air is limited to a C-133B type aircraft. Launch vehicle air frame pressurization shall be in accordance with Technical Order 21-SM65D-2J-2-9.

5.7.2 SURFACE TRANSPORTATION: Transportation of the vehicle shall be in accordance with requirements of Technical Order 21-SM65D-2J-2-6. When transporting the unit via any public thoroughfare, the utilization of material, equipment and personnel shall be in accordance with the provisions of local, state or interstate highway transportation regulations.

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6. NOTES:

6.1 INTENDED USE: This specification is intended to be used as the contract document which describes the launch vehicle and associated kits supplied under the terms of the contract.

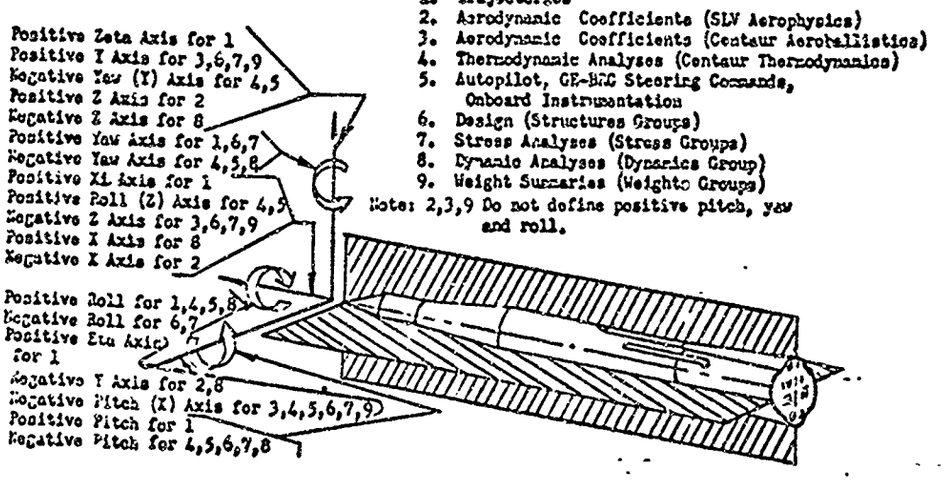
6.2 DEFINITIONS:

6.2.1 LAUNCH VEHICLE: Use of the term "launch vehicle" shall be intended to mean the Atlas Standard Launch Vehicle (SLV-3) as depicted on GD/C Drawing 69-00001, exclusive of the Agena upper stage and payload.

6.2.2 BASIC LAUNCH VEHICLE: Use of the term "basic launch vehicle" shall be intended to mean the basic booster as depicted in GD/C Specification 69-00160, exclusive of the mission peculiar kits.

6.3 COORDINATE AXIS SYSTEMS AND SIGN CONVENTIONS: Coordinate axis systems and sign conventions used by various design groups in reports and drawings at General Dynamics/Convair, are as follows:

COORDINATE AXIS SYSTEMS AND SIGN CONVENTIONS



Code No.
1. Trajectories
2. Aerodynamic Coefficients (SLV Aerophysics)
3. Aerodynamic Coefficients (Centaur Aerotallistics)
4. Thermodynamic Analyses (Centaur Thermodynamics)
5. Autopilot, GE-BAC Steering Commands, Onboard Instrumentation
6. Design (Structures Groups)
7. Stress Analyses (Stress Groups)
8. Dynamic Analyses (Dynamics Group)
9. Weight Summaries (Weights Groups)

Note: 2,3,9 Do not define positive pitch, yaw and roll.

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APPENDIX I

See applicable addendum for equipment list.

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APPENDIX II-A

DEVIATIONS

The following deviations, collected in GD/C Report 69-00033, shall form a part of this specification.

APPENDIX II-A-DEVIATIONS

Item	Document	Notes
1	MIL-C-5015D	
2	MIL-D-5028B	
3	MIL-D-5028B	
4	MIL-D-5028B	
5	MIL-D-5028B	
6	MIL-D-5028B	
7	MIL-D-5028B	
8	MIL-D-5028B	
10	MIL-S-5059A(1)	
11	MIL-B-5087A	
12	MIL-B-5087A	
13	MIL-B-5087A(1)	
14	MIL-P-5514B	
15	MIL-P-5518B	
18	MIL-P-5518B	
19	MIL-P-5518B	
20	MIL-P-5518B	
21	MIL-P-5518B	
22	MIL-P-5518B	
23	MIL-P-5518B	
27	MIL-P-6858A	
28	MIL-W-6858A	
29	MIL-W-6858A	
30	MIL-W-6858A	

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APPENDIX II-A-DEVIATIONS

Item	Document	Notes
33	MIL-W-8160B	
34	MIL-W-8160B	
35	MIL-W-8160B	
36	MIL-W-8160B	
39	MIL-W-8160B	
42	MIL-W-8160B	
44	MIL-W-8160B	
47	MIL-W-8160D	
48	MIL-E-8189A	
50	MIL-E-8189A	
52	MIL-E-8189A	
57	MIL-M-8555	
58	MIL-M-8555	
60	MIL-M-8555	
61	MIL-M-8555	
72	MIL-M-25047	
75	MIL-M-25474	
76	MIL-H-25475	
77	MIL-H-25475	
78	MIL-H-25475	
79	MIL-H-25475	
83	AFBM Exhibit 58-20	
86	AFBM Exhibit 58-20A	

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APPENDIX II-A--DEVIATIONS

Item	Document	Notes
90	ARDCM 80-1	
91	ARDCM 80-1	
92	ARDCM 80-1	
93	ARDCM 80-1	
97	Design Standardization	
104	7-00269B	
109	0-71012	
DCN 114R3	MIL-E-8189B	Effective EID 69-1690-1 thru 8
DCN 115R1	MIL-E-8189B	Effective EID 69-1600-1, -2, and -3, EID 69-1640 -1, -2, and -3
Section III, Page 9	AFBM Exhibit 58-20A	
Section III, Page 11	MIL-P-5518B	
Section III, Page 12	MIL-P-5518B	
Section III, Page 13	MIL-H-8775A	
Section III, Page 15	MIL-W-8160D	
Section III, Page 16	MIL-M-8555	
Section III, Page 18	MIL-I-26600	
Section III, Page 20	MIL-I-26600	
Section III, Page 22	MIL-W-8611	

APPENDIX II-A -DEVIATIONS

Item	Document	Notes
Section III, Page 23	MIL-W-8160D	
Section III, Page 24	MIL-W-8160D	
Section III, Page 25	MIL-W-8160D	
Section III, Page 27	MIL-E-81893	
Section III, Page 28	MIL-E-81893	
Section III, Page 29	MIL-E-81893	
Section III, Page 30	MIL-W-8611	
Section III, Page 31	MIL-S-5059A(1)	
Section III, Page 32	MIL-H-25475	
Section III, Page 34	MIL-W-6858B	
Section III, Page 35	MIL-W-6858B	
Section III, Page 36	MIL-W-6858B	
Section III, Page 40	MIL-W-8160D	
Section III, Page 41	MIL-W-8160D	
Section III, Page 42	MIL-W-8160D	

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APPENDIX II-A - DEVIATIONS

Item	Document	Notes
Section III, Page 44	MIL-W-8160D	
Section III, Page 45	AFBM Exhibit 58-20A	
Section III, Page 46	GD/A Specification 69-00202A	
Section III, Page 47	MIL-W-8160D	
Section III, Page 48	MIL-I-26600	
Section III, Page 50	MIL-W-6858B	
Section III, Page 51	MIL-W-8160D	
ECP 7000-29R2	MIL-M-8555	EID 69-1600-1 thru -13,-15 69-1610-1, -2 69-1620-1 thru -12 69-1640-1 thru -11, -18, -27, -37 69-1650-1 thru -11, -18, -27, -37 69-1690-1 thru -11, -18, -27, -37
ECP 7000-30R1	MIL-E-25366	EID 69-0071-1,-2, and -3
ECP 7000-32R1	MIL-I-26000	
ECP 7000-33R1	MIL-I-26600	
ECP 7000-34	MIL-I-26600	
ECP 7000-35	MIL-I-26600	
ECP 7000-38R1	MIL-M-25047A(1)	
ECP 7000-39	MIL-F-7179A	EID 69-1600-1, -2 and -3
ECP 7000-40	MIL-M-25047A(1)	
ECP 7000-41	MIL-I-26600	
ECP 7000-42R1	MIL-M-8555	

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APPENDIX II-A-DEVIATIONS

Item	Document	Notes
ECP 7000-43	MIL-E-8189B	
ECP 7000-44	MIL-I-8500B	
ECP 7000-44R1	MIL-I-8500B	69-1600-9, -15 and on 69-1610-1 and on 69-1620-14 and on 69-1640-13 thru -26, -28 and on 69-1650-13 thru -26, -28 and on 69-1690-13 thru -26, -28 and on 69-1660-1, -7, -10 and on
ECP 7000-45	MIL-S-6644A	
ECP 7000-47R1	MIL-E-8189B	EID 69-1690-1, -2 and -3
ECP 7000-48	MIL-E-5400D	EID 69-1640-1 thru -12 and 69-1600-1 thru -12
ECP 7000-53	MIL-W-8160D	
ECP 7000-56	MIL-E-8189B(ASG)	
ECP 7000-61	MIL-I-26600	
ECP 7000-64	MIL-I-26600	
ECP 7000-65	MIL-I-26600	EID 69-1690-1,-2,-3,-30
ECP 7000-68R1	MIL-M-8555	EID 69-1600-1 thru -13,-15 69-1610-1, -2 69-1620-1 thru -12 69-1640-1 thru -11, -18,-27,-37 69-1650-1 thru -11, -18,-27,-37 69-1690-1 thru -11, -18,-27,-37
ECP 7000-69	MIL-E-8189B	EID 69-1690-1 thru -10, -18, -27
ECP 7000-70	MIL-E-8189B(ASG)	
ECP 7000-71	MIL-M-25047A	EID 69-1600-1 thru -3

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APPENDIX II-A-DEVIATIONS

Item	Document	Notes
ECP 7000-75	MIL-E-8189B	EID 69-1690-4 and on
ECP 7000-78	MIL-I-26600	
ECP 7000-81	MIL-I-26600(2)	EID 69-1600-8, -9, -10, -12 and on
ECP 7000-82	MIL-B-5087A(ASG)(1)	
ECP 7000-83	MIL-I-26600	
ECP 7000-84	MIL-I-26600	EID 69-1600-7 thru -39 69-1690-18, -19, -20, -30
ECP 7000-85	MIL-I-26600	EID 69-1600-13 and on

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APPENDIX II-B

The following deviations, collected in Report GDA-CHA64-022, shall form a part of this specification for equipment designed or produced under Contract AF04(695)-710 and for other effectivities as noted herein.

Item	Document
1	MIL-STD-1A
2	MIL-STD-1A
3	MIL-STD-2B
4	MIL-STD-2B
5	MIL-HDBK 5
6	MIL-STD-8B
7	MIL-STD-8B
8	MIL-STD-10A
9	MIL-STD-12B
10	MIL-STD-15-1
11	JAN-STD-19
12	MIL-T-27B
13	MIL-STD-34
14	MIL-STD-106
15	MIL-STD-107A
16	MIL-HDBK 131
17	ANA-BUL-143d(1)
19	MIL-T-152B(1)
20	MIL-STD-176
21	MIL-STD-248A(1)
22	MIL-STD-248A(1)
23	MIL-STD-252
25	MIL-STD-275A
26	MIL-STD-275A
27	MIL-STD-275A
28	QQ-N-290
29	ANA Bulletin 391a(1)
33	ANA Bulletin 445
34.1, 35	MIL-STD-454
39	USAF Bulletin 527

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APPENDIX II-B (Cont)

Item	Document
40	USAF Bulletin 527
41	QQ-S-571D
42	MIL-STD-687
43, 44	MIL-STD-701C
46	MIL-STD-826
47	MIL-STD-831
48	MIL-S-866C(1)
50	MIL-STD-1241
51	MIL-STD-1247
52	MIL-STD-1247
54	MIL-S-4040C
55	MIL-S-4040C
56	MIL-S-4040C
57	MIL-S-4040C
58	MIL-S-4040C
59	MIL-S-4040C
60	MIL-S-4040C
61	MIL-E-4682C(ASG)
62	MIL-C-5015D
65	MIL-B-5028B (ASG)
66	MIL-B-5028B (ASG)
67	MIL-S-5059A(1)
68	MIL-B-5087A(1)
69	MIL-B-5087A(1)
70	MIL-B-5087A(1)
71	MIL-B-5087A(1)
72, 72.2	MIL-B-5087A(1)
74	MIL-E-5400D(ASG)
75	MIL-E-5400D(ASG)
76	MIL-E-5400D(ASG)
77	MIL-E-5400D(ASG)
79	MIL-E-5400D(ASG)
80	MIL-E-5400D(ASG)
81	MIL-E-5400D(ASG)
82	MIL-E-5400D(ASG)
83	MIL-E-5400D(ASG)
84	MIL-E-5400D(ASG)
85	MIL-E-5400D(ASG)
86	MIL-E-5400D(ASG)
87	MIL-E-5400D(ASG)

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APPENDIX II-B (Cont)

Item	Document
88	MIL-E-5400D(ASG)
89	MIL-E-5400D(ASG)
90	MIL-E-5400D(ASG)
91	MIL-E-5400D(ASG)
92	MIL-E-5400D(ASG)
93	MIL-E-5400D(ASG)
94	MIL-E-5400D(ASG)
95	MIL-E-5400D(ASG)
96	MIL-E-5400D(ASG)
97	MIL-E-5400D(ASG)
99	MIL-E-5400D(ASG)
100	MIL-E-5400D(ASG)
101	MIL-E-5400D(ASG)
102	MIL-H-5440D
103	MIL-D-5480D
105	MIL-C-5503B
106	MIL-C-5503B
107	MIL-C-5503B
108	MIL-C-5503B
109	MIL-C-5503B
110	MIL-C-5503B
112	MIL-F-5506A(1)
113	MIL-F-5509A(6)
114	MIL-F-5509A(6)
115	MIL-F-5509A(6)
116	MIL-F-5509A(6)
117	MIL-F-5509A(6)
118	MIL-F-5509A(6)
119	MIL-F-5509A(6)
120	MIL-F-5509A(6)
121	MIL-F-5509A(6)
122	MIL-F-5509A(6)
123	MIL-F-5509A(6)
124	MIL-F-5509A(6)
125	MIL-F-5509A(6)

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APPENDIX II-B (Cont)

Item	Document
126	MIL-P-5514B(ASG)
127	MIL-P-5514B(ASG)
128	MIL-P-5514B(ASG)
129	MIL-P-5514B(ASG)
130	MIL-P-5517B(ASG)
131	MIL-P-5518C
132	MIL-P-5518C
133	MIL-P-5518C
134	MIL-P-5518C
135	MIL-P-5518C
136	MIL-P-5518C
137	MIL-P-5518C
138	MIL-P-5518C
139	MIL-P-5518C
140	MIL-P-5518C
141	MIL-P-5518C
142	MIL-P-5518C
143	MIL-P-5518C
144	MIL-P-5518C
145	MIL-P-5518C
146	MIL-P-5518C
147	MIL-P-5518C
148	MIL-P-5518C
149	MIL-P-5518C
150	MIL-P-5518C
151	MIL-P-5518C
153	MIL-P-5518C
154	MIL-P-5518C
155	MIL-P-5518C
156	MIL-P-5518C
157	MIL-P-5518C
158	MIL-P-5518C
159	MIL-P-5518C
160	MIL-P-5518C
161	MIL-P-5518C

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APPENDIX II-B (Cont)

Item	Document
162	MIL-P-5518C
163	MIL-P-5518C
164	MIL-P-5518C
165	MIL-R-5520B
166	MIL-R-5520B
167	MIL-R-5520B
168	MIL-R-5520B
169	MIL-R-5520B
170	MIL-R-5520B
171	MIL-R-5520B
172	MIL-R-5520B
173	MIL-R-5520B
174	MIL-R-5520B
175	MIL-R-5520B
176	MIL-R-5520B
177	MIL-R-5520B
178	MIL-R-5606A(2)
179	MIL-R-5632
180	MIL-R-5757D(1)
181	MIL-H-6083B
182	MIL-I-6181D(Notice 2)
183	MIL-S-6644A(USAF)
184	MIL-S-6644A(USAF)
185	MIL-S-6644A(USAF)
187	MIL-S-6644A(USAF)
188	MIL-S-6644A(USAF)
189	MIL-S-6644A(USAF)
190	MIL-S-6644A(USAF)
191	MIL-S-6644A(USAF)
192	MIL-S-6644A(USAF)
193	MIL-S-6644A(USAF)
194	MIL-S-6644A(USAF)
195	MIL-S-6644A(USAF)
196	MIL-S-6644A(USAF)
197	MIL-S-6644A(USAF)

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APPENDIX II-B (Cont)

Item	Document
198	MIL-S-6644A(USAF)
199	MIL-S-6644A(USAF)
200	MIL-S-6644A(USAF)
201	MIL-S-6644A(USAF)
202	MIL-S-6644A(USAF)
203	MIL-S-6644A(USAF)
204	MIL-S-6721B(1)
205	MIL-T-6845(5)
206	MIL-W-6858B(1)
207	MIL-W-6858B(1)
208	MIL-W-6858B(1)
209	MIL-W-6858B(1)
210	MIL-I-6868B
211	MIL-P-6906A
212	MIL-E-7016C
215	MIL-C-7078A
218	MIL-F-7179A
219	MIL-I-7444B
220	MIL-W-7622B
221	MIL-A-7772B
222	MIL-A-7772B
224	MIL-A-7772B
225	MIL-A-7772B
226	MIL-T-7928E(1)
228	MIL-W-8160D
229	MIL-W-8160D
230	MIL-W-8160D
231	MIL-W-8160D
232	MIL-W-8160D
233	MIL-W-8160D
233.2	MIL-W-8160D(1) (Eff. all launch vehicles)
234	MIL-W-8160D
235	MIL-W-8160D
236	MIL-W-8160D
237	MIL-W-8160D

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APPENDIX II-B (Cont)

Item	Document
238	MIL-W-8160D
239	MIL-W-8160D
240	MIL-W-8160D
241	MIL-W-8160D
242	MIL-W-8160D
243	MIL-W-8160D
244	MIL-W-8160D
245	MIL-W-8160D
246	MIL-W-8160D
247	MIL-W-8160D
248	MIL-S-8169C(USAF)
249	MIL-S-8169C(USAF)
250	MIL-S-8169C(USAF)
251	MIL-S-8169C(USAF)
252	MIL-S-8169C(USAF)
253	MIL-E-8189B(1)(ASG)
254	MIL-E-8189B(1)(ASG)
255	MIL-E-8189B(1)(ASG)
256	MIL-E-8189B(1)(ASG)
257	MIL-E-8189B(1)(ASG)
255.2	MIL-E-8189B(2)
258	MIL-E-8189B(1)(ASG)
261	MIL-I-8500B
262	MIL-D-8510B(ASG)
263	MIL-S-8516C(1)
264	MIL-M-8555A
265	MIL-M-8555A
266	MIL-M-8555A
267	MIL-M-8555A
268	MIL-M-8555A
270	MIL-M-8555A
271	MIL-M-8555A
272	MIL-M-8555A
273	MIL-P-8564B(ASG)
274	MIL-P-8564B(ASG)
275	MIL-P-8564B(ASG)

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APPENDIX II-B (Cont)

Item	Document
276	MIL-P-8564B(ASG)
277	MIL-P-8564B(ASG)
278	MIL-P-8564B(ASG)
279	MIL-P-8564B(ASG)
280	MIL-P-8564B(ASG)
281	MIL-P-8564B(ASG)
282	MIL-P-8564B(ASG)
283	MIL-P-8564B(ASG)
284	MIL-P-8564B(ASG)
285	MIL-P-8564B(ASG)
286	MIL-P-8564B(ASG)
287	MIL-P-8564B(ASG)
288	MIL-P-8564B(ASG)
289	MIL-P-8564B(ASG)
290	MIL-P-8564B(ASG)
291	MIL-P-8564B(ASG)
292	MIL-P-8564B(ASG)
293	MIL-P-8564B(ASG)
294	MIL-P-8564B(ASG)
295	MIL-P-8564B(ASG)
296	MIL-P-8564B(ASG)
297	MIL-P-8564B(ASG)
298	MIL-R-8573A(3)
299	MIL-C-8603
300	MIL-W-8604
301	MIL-M-8609A
302	MIL-V-8628(AER)
303	MIL-V-8628(AER)
304	MIL-S-8634B(2)
307	MIL-H-8775B
308	MIL-H-8775B
309	MIL-H-8775B
310	MIL-H-8775B
311	MIL-H-8775B
312	MIL-H-8775B

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APPENDIX II-B (Cont)

Item	Document
313	MIL-H-8775B
314	MIL-H-8775B
315	MIL-H-8775B
316	MIL-H-8775B
317	MIL-H-8775B
318	MIL-H-8775B
319	MIL-H-8775B
320	MIL-H-8775B
321	MIL-H-8775B
322	MIL-H-8775B
323	MIL-H-8775B
324	MIL-H-8775B
325	MIL-V-8813(ASG)
326	MIL-V-8813(ASG)
327	MIL-V-8813(ASG)
328	MIL-V-8813(ASG)
329	MIL-V-8813(ASG)
330	MIL-V-8813(ASG)
331	MIL-V-8813(ASG)
332	MIL-V-8813(ASG)
333	MIL-V-8813(ASG)
334	MIL-V-8813(ASG)
335	MIL-V-8813(ASG)
336	MIL-V-8813(ASG)
337	MIL-V-8813(ASG)
338	MIL-V-8813(ASG)
339	MIL-V-8813(ASG)
340	MIL-F-8815(ASG)
341	MIL-F-8815(ASG)
342	MIL-F-8815(ASG)
343	MIL-F-8815(ASG)
344	MIL-F-8815(ASG)
345	MIL-F-8815(ASG)
346	MIL-F-8815(ASG)
347	MIL-F-8815(ASG)

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APPENDIX II-B (Cont)

Item	Document
348	MIL-F-8815(ASG)
349	MIL-F-8815(ASG)
350	MIL-F-8815(ASG)
351	MIL-F-8815(ASG)
352	MIL-F-8815(ASG)
353	MIL-F-8815(ASG)
354	MIL-F-8815(ASG)
355	MIL-F-8815(ASG)
356	MIL-F-8815(ASG)
357	MIL-F-8815(ASG)
358	MIL-F-8815(ASG)
359	MIL-F-8815(ASG)
360	MIL-F-8815(ASG)
361	MIL-F-8815(ASG)
362	MIL-F-8815(ASG)
363	MIL-F-8815(ASG)
364	MIL-F-8815(ASG)
366	MIL-A-8897(1)
367	MIL-A-8897(1)
368	MIL-A-8897(1)
369	MIL-A-8897(1)
370	MIL-A-8897(1)
371	MIL-A-8897(1)
372	MIL-A-8897(1)
373	MIL-A-8897(1)
374	MIL-A-8897(1)
375	MIL-A-8897(1)
376	MIL-A-8897(1)
377	MIL-P-9024B
378	MIL-W-9411A(2)
379	MIL-M-9868A
380	MIL-M-9868A
382	MIL-P-10971B(1)
386	MIL-M-13231A(2)
387	MIL-M-13231A(2)

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APPENDIX II-B (Cont)

Item	Document
388	MIL-C-14550
389	MIL-F-15733D(1)
390	MIL-I-16923D(1)
391	MIL-N-18307C(1)
392	MIL-P-19692B
393	MIL-P-19692B
394	MIL-P-19692B
395	MIL-P-19692B
396	MIL-P-19692B
397	MIL-P-19692B
398	MIL-P-19692B
399	MIL-P-19692B
400	MIL-P-19692B
401	MIL-P-19692B
402	MIL-P-19692B
403	MIL-P-19692B
404	MIL-P-19692B
405	MIL-P-19692B
406	MIL-P-19692B
407	MIL-P-19692B
408	MIL-P-19692B
409	MIL-P-19692B
410	MIL-P-19692B
411	MIL-P-19692B
412	MIL-P-19692B
413	MIL-P-19692B
414	MIL-P-19692B
415	MIL-P-19692B
416	MIL-C-20159B
417	MIL-C-21097B
418	MIL-S-22141
419	MIL-S-22146(1)
420	MIL-S-22216
421	MIL-C-22229(1)
422	MIL-C-22857B

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APPENDIX II-B (Cont)

Item	Document
424	MIL-M-25047A(1)
425	MIL-M-25047A(1)
426	MIL-M-25047A(1)
427	MIL-M-25047A(1)
428	MIL-M-25047A(1)
429	MIL-M-25047A(1)
430	MIL-M-25047A(1)
431	MIL-M-25047A(1)
432	MIL-M-25047A(1)
433	MIL-T-25363B
434	MIL-E-25366C
435	MIL-E-25366C
436	MIL-H-25475A
437	MIL-H-25475A
438	MIL-H-25475A
439	MIL-H-25475A
440	MIL-H-25475A
441	MIL-H-25475A
442	MIL-H-25475A
443	MIL-H-25475A
444	MIL-H-25475A
445	MIL-H-25475A
446	MIL-H-25475A
447	MIL-H-25475A
448	MIL-H-25475A
449	MIL-H-25475A
450	MIL-H-25475A
451	MIL-H-25475A
452	MIL-H-25475A
453	MIL-H-25475A
454	MIL-H-25475A
455	MIL-H-25475A
456	MIL-H-25475A
457	MIL-H-25475A
458	MIL-H-25475A

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APPENDIX II-B (Cont)

Item	Document
459	MIL-H-25475A
460	MIL-H-25475A
461	MIL-H-25475A
462	MIL-H-25475A
463	MIL-V-25517A(ASG)
464	MIL-V-25517A(ASG)
465	MIL-V-25517A(ASG)
466	MIL-V-25517A(ASG)
467	MIL-V-25517A(ASG)
468	MIL-V-25517A(ASG)
469	MIL-V-25517A(ASG)
470	MIL-V-25517A(ASG)
471	MIL-V-25517A(ASG)
472	MIL-V-25517A(ASG)
473	MIL-G-25867A(1)
474	MIL-G-25867A(1)
475	MIL-G-25867A(1)
476	MIL-G-25867A(1)
477	MIL-G-25867A(1)
478	MIL-G-25867A(1)
479	MIL-G-25867A(1)
480	MIL-G-25867A(1)
481	MIL-G-25867A(1)
482	MIL-G-25867A(1)
483	MIL-G-25867A(1)
484	MIL-G-25867A(1)
485	MIL-G-25867A(1)
487	MIL-C-26074A
488	MIL-E-26144(USAF)
489	MIL-E-26144(USAF)
490	MIL-E-26144(USAF)
491	MIL-E-26144(USAF)
492	MIL-E-26144(USAF)
493	MIL-E-26144(USAF)
494	MIL-E-26144(USAF)

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APPENDIX II-B (Cont)

Item	Document
495	MIL-E-26144 (USAF)
496	MIL-E-26144 (USAF)
497	MIL-E-26144 (USAF)
498	MIL-E-26144 (USAF)
499	MIL-E-26144 (USAF)
500	MIL-E-26144 (USAF)
501	MIL-E-26144 (USAF)
502	MIL-E-26144 (USAF)
503	MIL-C-26482C (1)
505	MIL-M-26512B (USAF)
505.3	MIL-M-26512C
506	MIL-I-26600 (2)
506.1 thru 506.21	MIL-V-27162
507, 508	MIL-C-27500 (USAF) (1)
509	MIL-R-27542 (USAF)
510	MIL-R-27542A (USAF)
511	MIL-R-27542A (USAF)
512	MIL-R-27542A (USAF)
513	MIL-R-27542A (USAF)
514	MIL-R-27542A (USAF)
515	MIL-R-27542A (USAF)
516	MIL-R-27542A (USAF)
517	MIL-R-27542A (USAF)
519	MIL-H-27894A (USAF)
520	MS 33620A
521, 522	MS 33790
523	MIL-I-45208A
526	MIL-E-45782A (MI)
527	MIL-E-45782A (MI)
528	MIL-E-45782A (MI)
529	MIL-E-45782A (MI)
530	MIL-E-45782A (MI)
531	MIL-E-45782A (MI)
532	MIL-E-45782A (MI)
533	MIL-E-45782A (MI)

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APPENDIX II-B (Cont)

Item	Document
534	MIL-E-45782A(MI)
535	MIL-S-45052
538.1	MIL-T-55155
538.2	MIL-T-55155
540	MIL-D-70327
541	WDT-Exh.-57-17
542	SSD-Exh.-62.181
542.1	SSD-Exh.-63-3
561.1, 561.2	MSFC-PROC-158B(1)
562	MSFC-PROC-158B
563	MSFC-PROC-158B(1)
564	MSFC-PROC-158B
565	MSFC-PROC-158B
566	MSFC-PROC-158B
567	MSFC-PROC-158B
568	MSFC-PROC-158B
569	MSFC-PROC-158B
570	MSFC-PROC-158B
571	MSFC-PROC-158B
571.1, 571.2	MSFC-PROC-158B(1)
574	GM6300.8-565C
575	GM6300.8-565C
576	GM6300.8-565C
578	GM6300.8-565C

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APPENDIX III

RUBBER ASSEMBLY AGE CONTROL LOG

Hydraulics

Part No.	Nomenclature
27-08550	Booster Servo Cylinder
27-08551	Booster Hydraulic Fluid Tank
27-08552	Sustainer Hydraulic Fluid Tank
27-08553	Sustainer Accumulator
27-08554	Booster Accumulator
27-85314	Sustainer Actuator Assembly
27-08565	Check Valve
27-08566	Booster Hydraulic Pump
69-85311	Vernier Outboard Actuator Assembly (SLV-3)
27-85312	Vernier Inboard Actuator Assembly
27-08587	Vernier Accumulator
27-08590	Sustainer Hydraulic Pump
27-08561	Booster Hydraulic Relief Valve (Vinson Only)
27-08568	Two-Way Valve
27-08569	Sustainer Hydraulic Relief Valve (Vinson Only)
27-08570	Pneumatic Relief Valve
27-08555	Staging Disconnect
27-08556	Staging Disconnect
27-08557	Rise-Off Disconnect
27-08558	Rise-Off Disconnect

Pneumatics

27-08245	LOX Tank Regulator (Fluidgenics Only)
27-08246	Fuel Tank Regulator (Fluidgenics Only)
27-08128	Staging/Rise-Off Disconnect

Propulsion

7-02315	Fuel Fill and Drain Valve
27-[illegible]36	Fuel Staging Valve, Aft
27-[illegible]29	Fuel Staging Valve, Forward
7-02287	Booster Fuel Pre-Valve
7-02281	Sustainer Fuel Pre-Valve
7-02337	Fuel Start Tank Vent Check Valve

Airframe

7-45435	Separation Fitting